The Builder.

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ILLUSTRATIONS.

Terrace Gardens, Foot's Cray Place, Sidcup.—Mr. T. H. Mawson and Mr. Dan Gibson, architects ..... *Extra Large Page Photo-Litho.*
"Steep-Hill," Jersey: Entrance Front.—Mr. Ernest Newton, Architect..... *Double-Page Photo-Litho.*
Design for a Memorial Bridge.—By Professor Beresford Pite, F.R.I.B.A..... *Double-Page Photo-Litho.*

Blocks in Text.

Sault-Ste-Marie:—
Lock Empty, showing Valves for Admission of Water..... Page 264
Lock in Process of Filling ..... „ 265
Sault-Ste-Marie:—
Below the Lock Gates ..... Page 265
Illustrations to Student's Column..... „ 275-276

CONTENTS.

The Canals of Canada 263
The New "Drainage By-Laws" of the London County Council 266
Notes 268
Further Notes on the British Association Meeting..... 270
Illustrations:—
Terrace Gardens, Foot's Cray Place, Sidcup 272
"Steep-Hill," Jersey 272
Design for a Memorial Bridge 272
Leicestershire Society of Architects..... 272
Exhibitions and Scholarships in Art..... 273
Competitions 274
Russian Timber Trade 274
Correspondence:—
The Double Choir of Glasgow Cathedral 274
Books Received..... 274
The Student's Column.—Gas and Gas Fittings—13..... 275
General Building News 276
Sanitary and Engineering News 278
Stained Glass and Decoration..... 278
Foreign 278
Miscellaneous 278
Legal:—
Employers' Liability Act 278
Recent Patents 279
Meetings 279
Some Recent Sales of Property 280
Prices Current of Materials 281

The Canals of Canada.

A GLANCE at the map of North America will show that the region of the great lakes is singularly fitted for a system of canals. At their head and furthest from the ocean we have to realise the inland sea of Lake Superior, 601 ft. above the sea level, covering 32,000 square miles, as stormy as, and perhaps more difficult of navigation than, many so-called seas, the gathering basin, if the expression may be used, of a region rich in the supply of wood and of minerals, the working of which, in Canadian soil at least, is but in an early period of development; and of the wheat-growing areas of the North-West. In this or in any other of the great lakes there is nothing to prevent their navigation by vessels of the largest tonnage, though from December to April navigation is rendered impossible by ice. Thus the tendency of the shipowners of the lakes is to increase the size of their vessels.

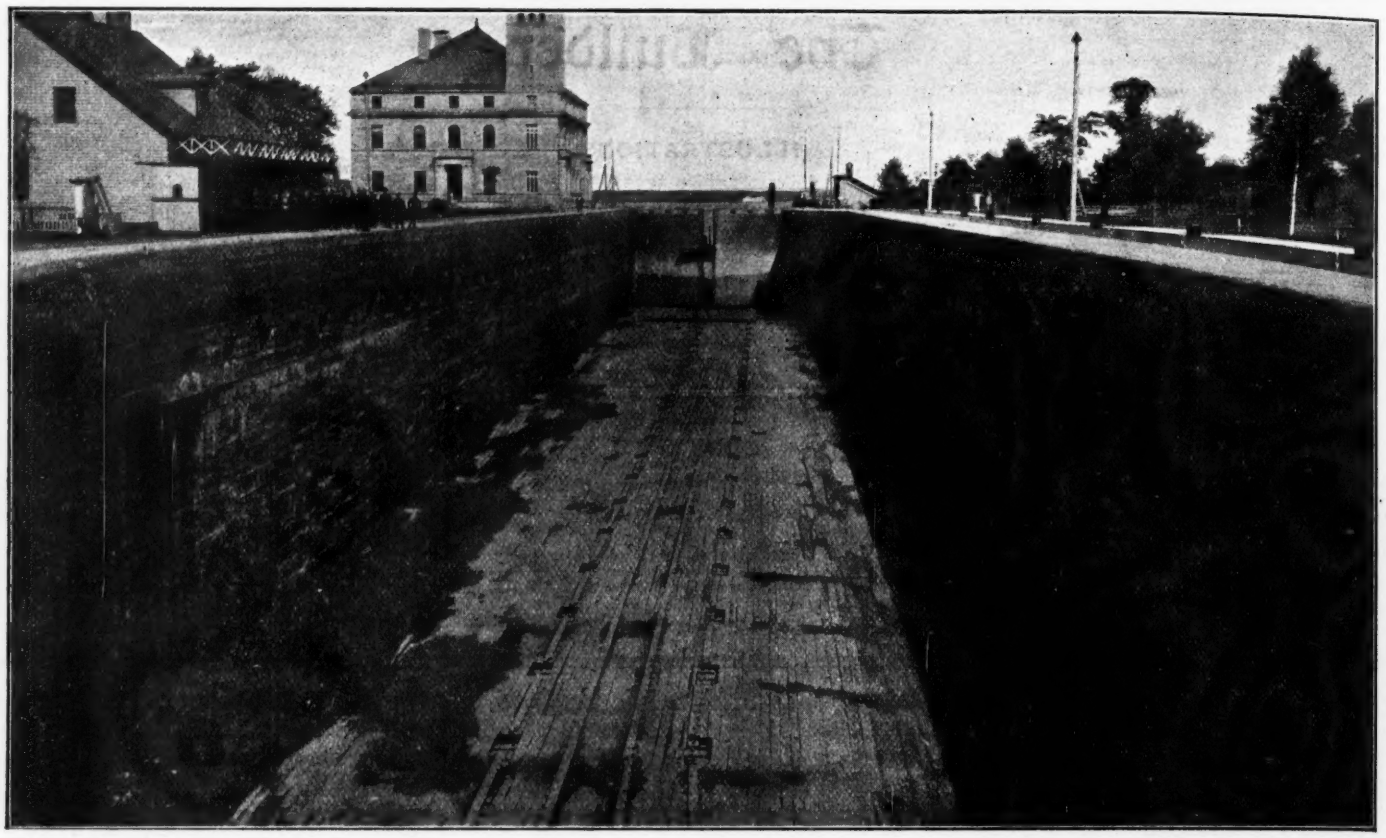
If the map be again noted it will also be seen that there is a very slight separation between Lake Superior and Lake Huron, which is 581 ft. above sea level, so that, except for a short and single obstacle, these two lakes and Lake Michigan, also 581 ft. above sea level, are one for the purpose of navigation. This obstacle is the rapids at Sault Ste. Marie, partly American, partly Canadian territory. Years ago they proved a trouble to the Indians and Hudson's Bay traders, and there is still preserved on the premises of the Lake Superior Company a small and primitive lock on one of the side streams, with a rise of 9 ft., which, together with some portage, enabled the early explorers and traders to raise their canoes from Lake Huron to Lake Superior.

The first communication between the two lakes—for the so-called St. Mary's River, the channel of which, varying in width, winds picturesquely for some fifty miles to the broader waters of Huron, is but a part of the lake—was completed by the State of Michigan in 1855. This, the first artificial link in the navigation of the great lakes, was a canal 1,800 yards long, 100 ft. wide, and 12 ft. deep, with two locks, each 350 ft. in length. This was succeeded by another lock, also on the American side, the canal being lengthened and deepened. This work, which was finished in 1879, provided a lock 515 ft. long, 80 ft. wide, and 39 ft. 6 in. deep. This, the Weitzel Lock, was found insufficient, and in 1897 there was opened another and larger lock known as the Poe Lock, 800 ft. between the gates and 100 ft. in breadth. On the Canadian side a canal and lock, the latter 800 ft. long and 60 ft. in breadth, were constructed by the Government and opened for traffic in 1895. Like the American locks, this is free of toll. The Falls of St. Mary still dash in curling foam from Superior to Huron as they did when, on an early summer day in 1671, Lusson, standing among a little knot of Frenchmen in the middle of a crowd of Indians collected from the vast forest around the lakes, with picturesque symbols took possession of these regions for the Crown of France. But on either side there now passes to and fro through these great gates one of the largest ship traffics in the world. The bellow of the steam signal, the splashing of the screw constantly are heard where, even fifty years ago, the Indian's fishing-canoe was almost the only boat in these waters.

The perpetual stream of traffic increases year by year. The lake steamers are growing in size, and some are now built to carry 7,000 tons deadweight on a draught of 19 ft. The so-called "whale-back" craft, shaped like a cigar with a kind of forecastle and poop which some years ago came into vogue, are now giving way to vessels worked by their own steam, low in the waist with a high-raised forecastle and poop topped by a species of deckhouse. Practically all the traffic of the lakes passes through the locks of Sault Ste. Marie, and then expands, so to speak, some going down Lake Michigan to United States ports only, some to the American ports on Huron and Erie and Ontario, notably Cleveland and Buffalo among these, and some to Canadian destinations. The vast extent of this traffic, scarcely realised in this country, is best exemplified by the following official figures:—

Comparative statement of Lake Commerce through United States and Canadian canals at Sault Ste. Marie, Michigan, and Ontario for the seasons of 1899 and 1900.

ITEMS.	Traffic for 1900.		Total traffic for		Increase, 1900.		Decrease, 1900.	
	United States Canal.	Canadian Canal.	Season 1900.	Season 1899.	Amount.	Per C'nt.	Amount.	Per C'nt.
Vessels, passages:								
Steamers, number.....	11,805	2,621	14,426	14,378	48	0	—	—
Sails, number.....	3,701	303	4,004	4,776	—	—	772	16
Unregistered, number	863	159	1,022	1,101	—	—	79	7
Total, number	16,369	3,083	19,452	20,255	—	—	803	4
Lockages, number	8,479	2,206	10,685	10,999	—	—	314	3
Tonnage:								
Registered, net tons.....	20,136,782	2,179,052	22,315,834	21,958,347	357,487	2	—	—
Freight, net tons	23,607,354	2,035,719	25,643,073	25,255,810	387,263	2	—	—
Passengers, number.....	36,313	22,242	58,555	49,082	9,473	19	—	—
Coal:								
Hard, net tons	476,131	39,384	515,515	841,281	—	—	325,766	39
Soft, net tons.....	3,488,558	482,904	3,971,462	3,099,606	871,856	28	—	—
Flour, barrels.....	6,123,458	637,230	6,760,688	7,114,147	—	—	353,459	5
Wheat, bushels	31,325,693	9,163,609	40,489,302	58,397,335	—	—	17,908,033	31
Grain, other than wheat, bushels	15,068,245	1,106,414	16,174,659	30,000,935	—	—	13,826,276	46
Manufactured and pig iron, net tons	117,086	18,499	135,585	214,585	—	—	79,000	37
Salt, barrels	318,358	10,537	328,895	316,336	12,559	4	—	—
Copper, net tons	126,671	4,395	131,066	120,090	10,976	9	—	—
Iron ore, net tons.....	15,439,617	1,003,951	16,443,568	15,328,240	1,115,328	7	—	—
Lumber, M. ft. B. M.	898,093	11,558	909,651	1,038,057	—	—	128,406	12
Silver ore, net tons	110	—	110	487	—	—	377	77
Building stone, net tons ...	43,912	4,990	48,902	39,063	9,839	25	—	—
General merdse., net tons.,.	460,760	80,637	541,397	587,484	—	—	46,087	8



Sault-Ste-Marie: Lock Empty, showing Valves for Admission of Water.

Estimated Value of Freight passing St. Mary's Falls Canal, Michigan, and Sault Ste. Marie Canal, Ontario, for the Season of 1900.

Items.	Quantity.	Price per Unit.	Valuation.
		dols.	dols.
Coal, anthracite, net tons	515,515	5·25	2,706,454
Coal, bituminous, net tons	3,971,462	3·00	11,914,386
Flour, barrels	6,760,688	4·00	27,042,752
Wheat, bushels	40,489,302	·70	28,342,511
Grain, other than wheat, bushels	16,174,059	·87	14,071,953
Manufactured iron, net tons	115,510	100·00	11,551,000
Pig iron, net tons	20,075	17·50	351,813
Salt, barrels	328,895	1·00	328,895
Copper (refined and matte), net tons	131,066	300·00	39,319,800
Iron ore, net tons	10,443,568	3·75	61,663,380
Lumber, M. ft. B. M.	909,651	16·50	15,009,241
Silver ore, net tons	110	125·00	13,750
Building stone, net tons	48,902	12·00	586,824
General merchandise, net tons	541,397	100·00	54,139,700
Total			267,041,959·48

Average value per ton of freight for season of 1900, 10·41 dols.
Average value per ton of freight for season of 1899, 11·14 dols.

The canal which at present is of the first importance in connexion with the eastward-bound through traffic is the Welland Canal, which passes by Niagara and connects Lakes Huron and Ontario, and is the second artificial link in the navigation of the Lakes. The third and succeeding links are the canals between the Bay of the Thousand Isles, where the St. Lawrence leaves Lake Ontario and Montreal, consisting of the Williamsburg Canals, namely, Gallops, Rapide Plat, and Farrans Point, respectively eight, four, and one mile in length; the Cornwall Canal, eleven miles; the Soulange, 13½ miles; and lastly, close to Montreal, the Lachine Canal, 8½ miles long with five locks, and a total lift of 45 ft. The Welland Canal is of importance not only to Canada, but also in less degree to the United States, since Buffalo, on Lake Erie, is the port and centre of transportation for the lake trade to the United States. The Welland Canal is twenty-seven miles long with twenty-five locks, and a depth of 14 ft.; indeed, the completion of the works on the Soulange Canal, on the northern bank of the St. Lawrence above Montreal, gives a uniform depth of 14 ft. on the through canal system of Canada. To attain this end large sums have been expended by the Government, and vessels capable of carrying cargoes up to 3,000 tons will be able to pass through from any port of Lake Superior to Montreal. On the other hand, the increasing class of vessels of deeper draught, which are now so much in favour and so profitable, will not be able to ply through to Montreal, and with the present satisfactory freight rates it is certain that more and more of these vessels will be built.

There are those who think also that with a canal system capable of accommodating vessels of greater draught a communication might be established between the lakes and Europe. Large, however, as are many of the steamers now plying on the lakes, they would require to be different in build for ocean traffic, with a higher freeboard and stronger construction. Severe as are the storms and high as the seas can run on these lakes, the rolling swells of the Atlantic are unknown, and the traffic is in the summer only. But even with a 14-ft. channel some ocean steamers could trade between Europe and the lakes and carry a considerable cargo.* How substantial is the increase in cost through the present necessity of transhipment is well shown by the following figures, which, though not recent, are clear as examples:—

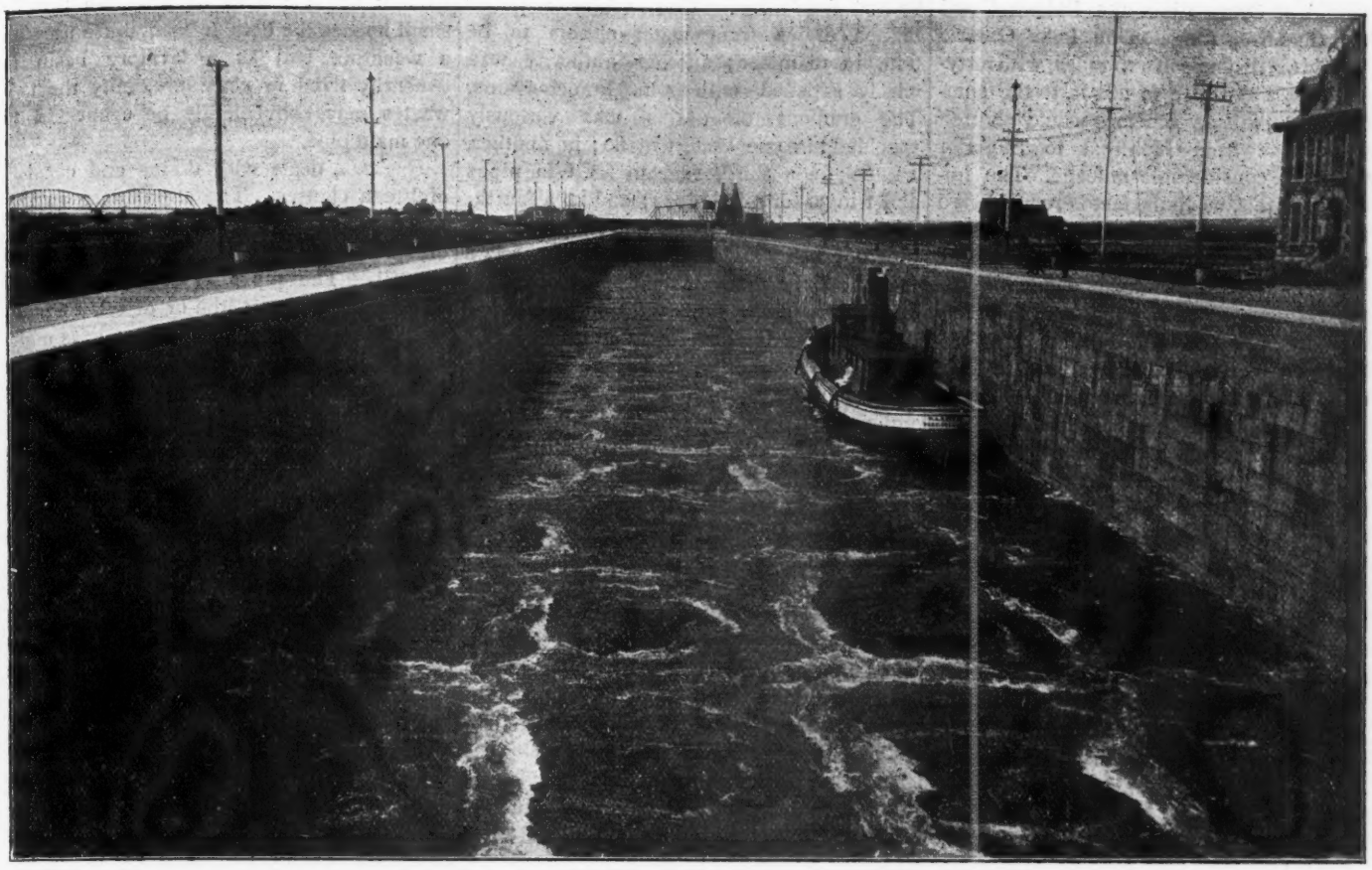
"Statement made by the Railroad and Warehouse Commission, showing market value of No. 1 Northern wheat at Duluth on September 4, 1890, as compared with actual sale of 8,000 bushels Duluth No. 1 Northern wheat on same day at Liverpool for delivery in London, c.i.f. (cost, freight, and insurance):—

	Cents.
September 4, Duluth quotation for No. 1 Northern	68·00
Duluth elevator and inspection charges	0·85
Lake freight and insurance, Duluth to Buffalo	4·78
Elevator charge and commission at Buffalo	1·00
Canal freight, Buffalo to New York	2·50
Elevator charged, &c., in New York, viz., demurrage, towing, transferring, and trimming	2·00
Ocean freight and insurance, New York to London	7·20
Shrinkage in weight, Duluth to London	0·50
Cost in London, c.i.f.	86·83
September 4, sold in Liverpool for London delivery, 1,000 quarters (8,000 bushels) Duluth No. 1 Northern wheat at 28s. 1½d. per quarter (480 lbs.), or 84⅜c. per bushel (say)	84·38
Difference	02·45

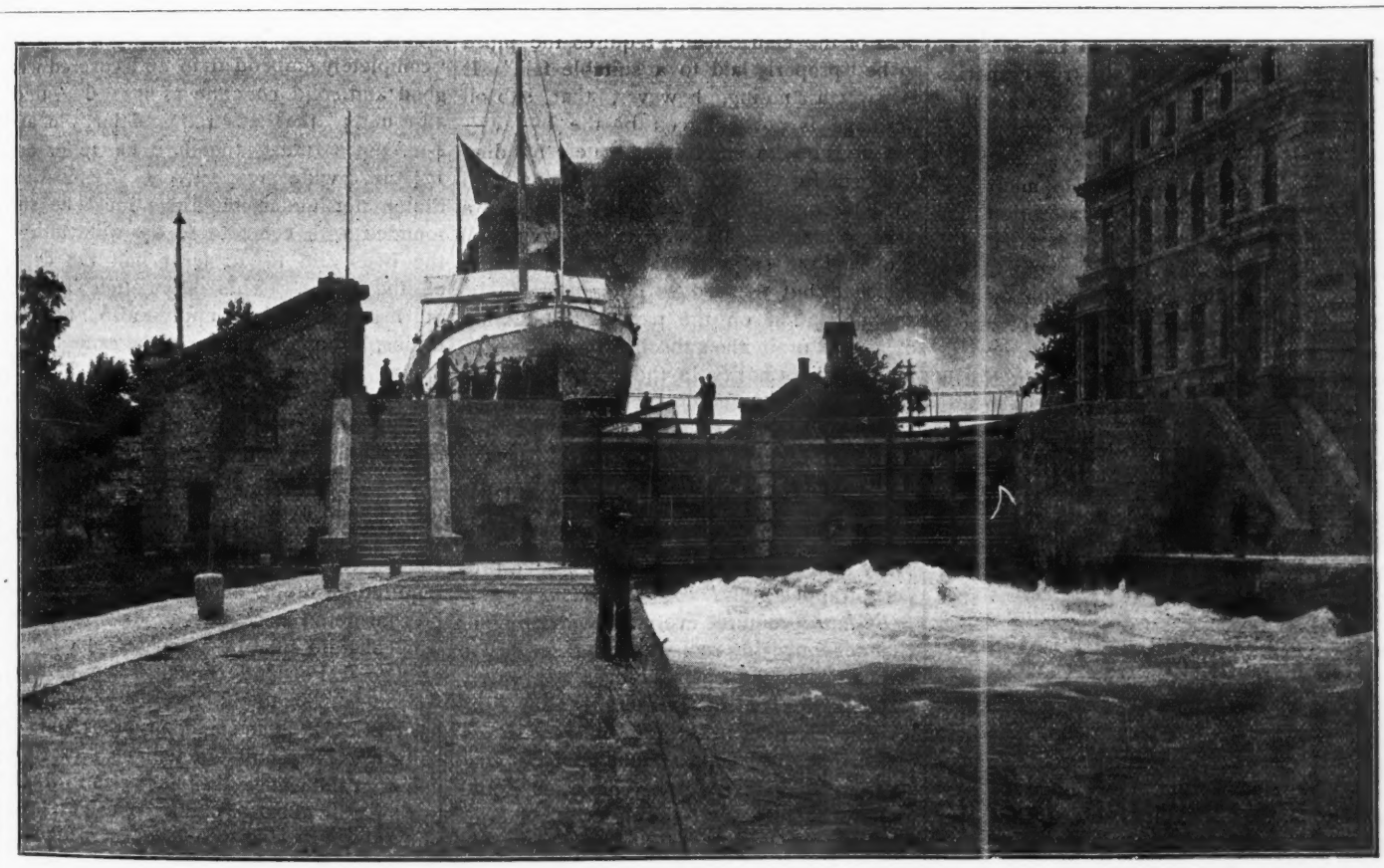
Showing that on that day the market in London was about 2½c. lower than that of Duluth."

A point which will be at once noted in the above statement is that the lake and canal freights are higher than the ocean freights—the freight from Duluth to New York is 7·28

* During the winter 1900-1 the Lake Superior Company despatched four steamers with cargoes of ore from Lake Superior to the Bristol Channel.



Sault-Ste-Marie: Lock in Process of Filling.



Sault-Ste-Marie:. Below the Lock Gates.

against 7·20 from New York to London. The reason, no doubt, is that on the lakes the tonnage and the seasons are limited ; on the Atlantic there are plenty of ships, and the traffic continues from year's end to year's end.

But when the canal system of Canada is under consideration it needs only a glance at the map to show that for the through traffic between Superior and Montreal, or one may say from Port Arthur in the west to Montreal in the east, a distance of 1,274 miles—Montreal representing the point of departure for the ocean—there are routes which might be shorter than those now existing. One of these is the Trent Canal system—to connect the eastern end of Georgian Bay with Lake Ontario—a scheme which, valuable in conception, appears to be wholly inadequate as it is being carried out. Progress in the work is slow, and even when completed the size of the canal will be such that it will be quite useless except for small traffic. There is also the proposed, but still wholly indefinite, scheme to make a connexion between Georgian Bay and Ottawa by way of French River, Lake Nipissing, and the Ottawa River, and which was recommended in the report of a Special Committee of the Canadian Senate in 1898.

It would at Ottawa join the Rideau Canal which runs from Kingston on Lake Ontario to Ottawa, a distance of 126 miles, with forty-nine locks, and a rise of 282 ft. to the summit. Each of these schemes would shorten the distance from Montreal to Superior by a very considerable mileage. The importance of this, when the fact is remembered that the navigation of the lakes is not open for more than about seven months of the year, cannot be overrated; a day on the lakes is much more valuable than in purely ocean traffic. To those who are unacquainted with the already immense trade on the lakes the importance of the canals of Canada is naturally impossible of appreciation. But it must be clearly borne in mind that it will continue to increase. Canada has large undeveloped mineral resources; the North-West is a great field of agricultural produce. The gravitation of population to the United States instead of Canada is now less marked, and as labour becomes more obtainable in the Dominion so will development proceed, and with it there will be more traffic to be handled. Thus the importance of the canal system of Canada will be constantly increasing. From a British point of view, the value of an outlet for the wheat-growing districts of Canada through Imperial territory to a point whence grain can be shipped to the United Kingdom can hardly be overrated. In time of war, with the Atlantic patrolled by powerful cruisers, the wheat-fields of the wide regions to the west of Lake Superior would be the true granaries of England. The canals of Canada are thus essential, not only as a link for commercial purposes, but also for the well-being of the mother country. Their development and perfection are more worthy of attention than fantastic plans for national granaries in the British Islands. Duplication of routes, rapidity of locking, the prevention of accidents by widening and deepening of canals and channels, are essential so as to prevent any interruption of traffic between the North-West of Canada and the ocean, because in the Canadian wheatfields there exists a certain and vast supply of grain for Great Britain in time of war so long as communication is adequate and uninterrupted in Canada, and the passage across the Atlantic is efficiently safeguarded.

THE NEW "DRAINAGE BY-LAWS" OF THE LONDON COUNTY COUNCIL.

IT is somewhat strange that, although the power of making by-laws "for regulating the dimensions, form, and mode of construction . . . of the pipes, drains, and other means of communicating with sewers" was conferred on the Metropolitan Board of Works by the Metropolis Local Management Act of 1855, neither the Metropolitan Board of Works nor its successor, the London County Council, has exercised its power directly until this year. Indirectly through the Vestries the power has been exercised, but the result has been much less satisfactory than if the central authority had undertaken the work. The by-laws of different districts varied in many important details. In one district no house-drain must be more than 6 in. in diameter; in another, the diameter of main house-drains must be *at least* 6 in. One vestry required branch-drains from water-closets to be 6 in. in diameter; another authority was wisely satisfied with 4-in. branch-drains. The gradient of drains was variously specified: in one case, 1 in 80; in another, 1 in 60; in a third, 1 in 40 for 6-in. pipes and 1 in 30 for 4-in. pipes; and in a fourth, "half-inch in each pipe," the length of the pipe not being stated. These are merely a few out of the many instances which might be given to show the confusion which has resulted from the devolution of its power by the central authority, and there cannot be two opinions as to the advantage of one uniform code of by-laws applicable to the whole of London County. Whether the by-laws which have recently been adopted by the County Council are satisfactory in themselves, remains to be seen.

The older by-laws made by the County Council under the Public Health (London) Act, 1891, to regulate the construction of water-closets, &c., remain in force, with the exception of the last clause of No. 3, which dealt with the ventilation of water-closet traps, and the whole of No. 4, which contained the regulations respecting soil-pipes. These have been repealed in favour of the altered requirements in the new Drainage By-laws. The alterations will be more particularly referred to hereafter.

By-law 1 deals with subsoil drainage. No objection can be made to the method of construction specified, except to the vagueness of the clause which requires the pipes to be "properly laid to a suitable fall." It is worth noting, however, that subsoil drainage is not enforced by the by-law—"A person who shall erect a new building *and** shall cause the subsoil of the site of such building to be drained by means of a drain communicating with any sewer," shall construct the subsoil-drains in the manner specified, but there does not appear to be any obligation on the part of a building-owner to drain the subsoil. Probably each municipal authority in the metropolis will sooner or later insist on such drainage being carried out wherever, in the opinion of the Borough Surveyor, it is necessary.

By-law 2 specifies that drains for conveying surface-water must be constructed in the same manner as sewage drains, and that every inlet to such drains must be "a properly-trapped gully."

By-law 3 requires every rainwater pipe or channel conveying roof-water to a sewer "to discharge in the open air over a properly trapped gully, or into such gully above the level of the water in the trap thereof." Rainwater pipes *or channels* must not be constructed to receive "any solid or liquid matter from any water-closet, urinal, slop or other sink or lavatory." Baths are not mentioned, and the waste water from these may therefore be conveyed into rainwater pipes or channels if desired. The reason for this exception is doubtless that bath water is, as a rule, less foul than the discharges from the fittings mentioned, but, after all, there is usually very little difference between bath water and lavatory water, and both are often less foul than rainwater draining from sooty and bird-polluted roofs. If bath-wastes may be connected with rainwater pipes, there seems to be little reason for prohibiting the connexion of lavatory wastes. On the other hand, it ought not to be forgotten that in small houses the bath is sometimes used as a washtub, and as a lavatory basin is generally fixed in close proximity the two wastes may conveniently be connected to one main pipe.

By-law 4 deals with drains and consists of fifteen clauses. The stipulations in this by-law, unless otherwise stated, refer to all drains except those for the drainage of the subsoil. The pipes must be "of glazed stoneware or of cast-iron or of other equally suitable material," and must not pass under any building except "where any other mode of construction may be impracticable." Drains must be "of adequate size," the diameter of sewage-drains to be "not less than 4 in.;" the size of drains from rainwater pipes and surface-gullies is not clearly stated, but apparently 3-in. pipes will be allowed.

Every drain must be laid on a bed of concrete "not less than 6 in. thick, and projecting on each side of the drain to an extent at east equal to the external diameter of the drain." The width of the concrete must therefore be at least 12 in. for 3-in. stoneware pipes, 15¾ in. for 4-in., 18¾ in. for 5-in., 21¾ in. for 6-in., and 31½ in. for 9-in.; the width will be slightly less for iron pipes—namely, 10⅞ in. for 3-in. pipes, 14¼ in. for 4-in., 17¼ in. for 5-in., and 20¼ in. for 6-in. This stipulation applies to all *underground* iron drains, and to stoneware drains not under buildings. In the case of stoneware drains under buildings, the pipes must be "completely embedded in and covered with good and solid concrete at least 6 in. thick all round;" the beds required for 3-in. and 4-in. pipes must therefore be 16 in. and 17¼ in. wide respectively. Stoneware drains not under buildings must be surrounded with concrete to the full width of the beds and to at least half the depth of the pipes. This stipulation appears at first sight to apply also to iron drains, but a later clause of the same by-law shows that this is not intended, as it specifies that an iron drain passing under a building must be "laid on a bed of good concrete in accordance with the requirements of this by-law relating to drains which do not pass under a building." Not a word is here said as to embedding the drain in concrete to half its depth, and if this is not required for drains under buildings, it cannot be considered necessary for external drains. The concrete must be composed of one part of "good Portland cement," two parts of "clean sand," and six parts of "clean gravel, hard brick broken small, or other suitable ballast." Jerry-builders will be pleased to note that the clause does not permit them to use concrete of better quality, or compel them to break the gravel, however coarse it may be.

Cast-iron drain-pipes may have flange-joints "securely bolted together with some suitable insertion," or socket-joints "made with molten lead properly caulked." The sockets must not be less than 2½ in. deep, and 3½ in. in diameter for 3-in. pipes, 4½ in. for 4-in, 5¾ in. for 5-in., and 6¾ in. for 6-in. The weights of cast-iron drain-pipes per 9 ft. length (including flanges or sockets and beaded spigots) must be 110 lbs. for 3-in. pipes, 160 lbs. for 4-in., 190 lbs. for 5 in., and 230 lbs. for 6 in. Such pipes may be fixed above ground in buildings, if "carried at least at each joint on adequate piers or

* The italics here and throughout this article are ours.

other sufficient supports, constructed of iron, stone, brick, or cement concrete."

Stoneware drain-pipes must have "socket joints properly put together with cement or other equally suitable material." The kind of cement — whether Portland, Roman, Parian, Keene's or other—is not stated, but doubtless Portland cement is intended. Admixture with sand is apparently prohibited, but surely this is a mistake. The thickness of the stoneware, and the diameter and depth of the sockets are specified for the different sizes of pipes.

Every drain must be "laid with a suitable fall," but we are not informed what fall is considered suitable. Apparently this detail is left for the consideration of the various Borough Councils, on account of the different depths of the sewers in different parts of the metropolis. "Whenever practicable . . . . adequate means of access" must be provided at each end of a drain passing "beneath" a building; this is doubtless intended to apply also to an iron drain carried on supports within a building. Drains passing "beneath a wall" must be protected from injury (which might be caused by the settlement of the wall) "by means of an arch, flagstone, or iron support, which shall not bear on the drain."

Every inlet to a drain, except those provided for ventilation, must have "an efficient trap . . . capable of maintaining a sufficient water-seal," but bell-traps, dip-traps, and D-traps are prohibited.

Every drain, except a subsoil drain, must be "so constructed as to be water-tight, and to be capable of resisting a pressure of at least 2 ft. head of water." This clause is a most important one, and has already been interpreted in different ways. It does not appear to us to be intended to throw upon the builder or building owner the *onus* of applying the water-test, but merely to give the municipal officers power to apply it if they desire to do so. If the intention had been to render the water-test obligatory on the builder, the wording would surely have been on the lines of the other clauses in the by-laws, and would have read as follows:—"And *shall cause such drain to be tested with* a pressure of at least 2 ft. head of water."

By-law 5 specifies that every drain must be trapped at a point "as near as may be practicable" to its junction with the sewer. "Adequate means of access to such trap" must be provided. This may take the form of "a separate manhole or other separate means of access." The meaning intended to be conveyed by the use of the word "separate" is not obvious. It surely cannot mean that the manhole may not also be used as an inspection-chamber for the drains or as a junction-chamber for branch drains.

By-law 6 requires manholes and other means of access to be "water-tight up to the level of the adjoining ground-surface or roadway," and to be fitted with suitable covers, those within buildings to be air-tight.

By-law 7 prohibits right-angled junctions (both vertical and horizontal) in drains.

By-law 8 deals with the ventilation of drains, and specifies three methods which may be adopted, namely, (1) a low-level inlet near the intercepting trap, and an outlet pipe or shaft "as far distant as may be practicable," (2) a low-level inlet near the head of the drain, and an outlet shaft "as near as may be practicable to the trap," and (3) two "suitable vertical pipes or shafts" carried up "to such heights and in such positions that when either acts as an inlet the other may be a safe outlet for foul air." Each opening is to be fitted with a grating, the apertures in which must not be less than the sectional area of the pipe or shaft Bends must not be formed in any ventilating pipe or shaft, "except where unavoidable." Soil-pipes and waste-pipes from slop-sinks may be used as ventilating-pipes for drains not more than 4 in. in diameter, if the pipes are not less than $3\frac{1}{2}$ in. in diameter, and are otherwise satisfactory "as to the position, height and mode of construction"; special ventilating-pipes must, however, be not less than 4 in. in diameter, and must be constructed in all other respects as soil-pipes.

By-law 9 prohibits drain-inlets within buildings, except from water-closets, slop-sinks, and urinals.

By-law 10 specifies that every waste-pipe from a lavatory and sink (other than slop-sinks) must be trapped immediately beneath the fitting by "an efficient siphon-trap," the traps and pipes to be of "lead, iron, or stoneware." Neither the diameters nor weights are stated. Copper, brass, and white metal are not mentioned, but surely this is an oversight. Bell-traps, dip-traps, and D-traps are expressly prohibited, and every siphon-trap must have "adequate means for inspection and cleansing," and be ventilated into the external air whenever this is "necessary to preserve the seal of such trap." Baths are not included in the foregoing provisions, and the waste-pipes may, apparently, be of any material and untrapped.

"*Every*" waste-pipe, however, must discharge in the open air over or into a trapped gully or over a channel leading to such a gully.

By-law 11 contains some of the new regulations regarding soil-pipes. The absolute prohibition of internal soil-pipes in new buildings is now withdrawn, but such pipes must be of drawn lead (*not* cast-iron), and will only be allowed when it is not "practicable" to fix the pipe outside. No alteration has been made in the *weights* of lead and iron soil-pipes, but the *minimum* thickness of iron is now specified, namely, $\frac{3}{16}$ in. for $3\frac{1}{4}$-in. and 4-in. pipes, and $\frac{1}{4}$ in. for 5-in. and 6-in. pipes. This alteration has probably been made so that irregular castings can be rejected. Iron pipes may have flange joints "securely bolted together with some suitable insertion," or socket joints "made with molten lead properly caulked." *Internal* lead soil-pipes must have "proper wiped plumbers' joints"; the joints for *external* lead soil-pipes are not specified. The waste pipes from slop-sinks may be connected to soil-pipes, but rainwater pipes and the wastes from other sinks and baths must not be so connected. There is no prohibition in this clause against the connexion of lavatory waste-pipes to soil-pipes, but this is doubtless an oversight. The trapping of a soil-pipe at the foot is still expressly prohibited, but the unnecessary provision about carrying the soil-pipe above the highest point of the roof, and 3 ft. above any window within 20 ft. of the open end of the pipe, has been omitted.

By-laws 12 *to* 16 deal with the joints from lead to iron, stoneware to lead, lead to stoneware, iron to stoneware, and stoneware to iron. In the old by-laws only three of these joints were specified, namely, lead to iron, stoneware to lead, and stoneware to iron; in these cases the same type is specified in the new by-laws as in the old. The lead to stoneware joint may be made by means of "a flanged thimble of copper, brass, or other suitable alloy" connected to the lead pipe by "a wiped or overcast metallic joint," the flanged end of the thimble to be inserted into the stoneware socket and the joint made with Portland cement. The iron to stoneware joint may be made by placing the beaded spigot of the iron into the stoneware socket, and filling the annular space with Portland cement. In every case, however, alternative methods may be adopted if "equally suitable and efficient." This may lead to different methods being practised in different boroughs, but has the advantage of allowing new inventions to be adopted. An important innovation is that, whereas in the old by-laws the specified joints were only applicable to connexions with soil-pipes, they are now enforced for connexions with soil-pipes, ventilating-pipes, and waste-pipes.

By-law 17 takes the place of the last clause of the old By-law 3, and specifies that, where two or more water-closets are connected to one soil-pipe, the trap of each must be "ventilated into the open air at a point as high as the top of the soil-pipe, or into the soil-pipe above the highest water-closet." The ventilating-pipe must have an internal diameter of not less than 2 in., and must be connected to the trap in the manner specified in the old by-law. The new matter states that trap ventilating-pipes must be of drawn lead if fixed inside the building, or of drawn lead or cast-iron if fixed outside the building. The weights of the pipes are stated in addition to other details.

By-law 18 deals with slop-sinks and urinals, the two kinds of fittings being treated exactly alike. Every fitting must have "an efficient siphon trap," which must be ventilated where necessary after the manner prescribed for a water-closet trap. It is not clearly stated that, if a water-closet and slop-sink are connected to one soil-pipe, the traps of the two fittings must be ventilated, although trap ventilation is then more necessary than in the case of two water-closets. The waste-pipes from slop-sinks and urinals must be constructed as soil-pipes, but the internal diameter may be 3 in. instead of $3\frac{1}{2}$ in. The weights must be as follows:—Lead, 60 lbs. per 10 ft. length; cast iron, 40 lbs. per 6 ft. length. The provision of a 3-in. waste-pipe for a single urinal is both extravagant and insanitary; how can it possibly be kept clean by the one-gallon flush commonly allowed?

By-law 19 throws upon the *owner* of a building the duty of maintaining "in a proper state of repair all pipes, drains, and other means of communicating with sewers, and the traps and apparatus connected therewith."

By-law 20 prescribes the penalties for offences "against any of the foregoing by-laws."

By-law 21 specifies that "these by-laws shall, *as far as practicable*, apply to any person who shall construct or reconstruct any pipe or drain or other means of communi-

cating with sewers, or any trap or apparatus connected therewith, *so far as he shall effect any such works* in any building erected before the confirmation of these by-laws, as if the same were being constructed in a building newly erected." A certain amount of latitude is allowed by the phrase "so far as practicable" and no fault need be found with this; the words "so far as he shall effect any such works" appear to have been inserted for the purpose of narrowing the scope of the by-law, but their exact meaning is not by any means clear. If, for example, a person wishes to ventilate the traps of two water-closets served by one soil-pipe, does the by-law compel him to reconstruct the soil-pipe, or does it merely compel him to construct the trap-ventilation pipes in the specified manner? We believe that the by-law involves only the latter and not the former, but the final interpretation will probably have to be given in the law-courts.

By-law 22 defines the word "person" to include "any body of persons, whether corporate or unincorporate," and *By-law* 23 declares that the by-laws "shall not extend to the City of London."

It is obvious from this cursory review of the by-laws that they are not by any means perfect. There are sins of omission and of commission, and the meaning is not everywhere clear. Some of the requirements are unnecessarily onerous, but in the main the by-laws are a fair compromise between jerry-work and extravagance. In some cases the provisions are less stringent than those in the former by-laws, and an amount of latitude is allowed which cannot in the end fail to be advantageous, although at first it may lead to friction.

NOTES.

The Liverpool Cathedral.

IT is evident that there is to be a new competition for the Liverpool Cathedral, which we think is rather unjustly throwing over Mr. Emerson, whose design was practically selected in the former competition. It is true that a new design must in any case be made, the selected site being entirely different in its nature and surroundings from the originally proposed one. This however is no doubt a question on which there may be difference of opinion; the new committee is not in any direct way bound by the action of the old one. But what we do regret to see is the foolish mischievous resolution that "the style of the new cathedral should be Gothic." Here is the ecclesiological prejudice in church architecture in full blow again; a great chance for the production of a grand and original piece of modern church architecture is deliberately thrown away, and we shall have another specimen of imitation mediævalism. Not only is the Gothic style unsuitable for a modern cathedral; the fatuity resides in demanding a special "style" at all. Architects should be invited to design a cathedral, simply, and be left to consult their own genius as to its treatment. A committee who could make a formal demand for a "Gothic" cathedral must be entirely behind the age in their ideas, and entirely ignorant of the spirit and tendency of the best modern thought in architecture. By making such a demand they have practically thrown away a great opportunity.

The Lightning Conductors at Westminster Abbey.

MR. KILLINGWORTH HEDGES is to be congratulated on the system of lightning conductors which now protect Westminster Abbey. In protecting a building of national importance, it is very difficult to decide how far we should cover it with a network of wires. Mr. Hedges seems to have fixed upon a happy mean; there are sufficient conductors to make the main buildings of the Abbey almost absolutely safe, and yet they are very unobtrusive. He uses ⅜ in. seven-strand copper cables, which are carried horizontally along the apex of the roof of the nave and transepts and also over Henry VII.'s Chapel. The towers, lantern, and other higher parts are protected by similar conductors, which are joined on to the main cables. Along the horizontal conductors are fixed thirty four-point aigrettes, fastened to the cables by substantial joint boxes, which are filled up with solder, and ought therefore to last as long as the cable. The pinnacles all round the roof are each protected by ¼-in. solid copper wire, and so it will be seen that the system is fairly elaborate. We are glad that there are no absurd tall spear points sticking up all over the roof; in our opinion Mr. Hedges' arrangements are quite as efficient. We do not quite understand why Mr. Hedges keeps the vertical conductors 6 in. from the walls by means of special holdfasts. Surely there is nothing inside the building to which the lightning might possibly side flash. The earthing arrangements are very complete, a small pipe being laid from the nearest rain-water pipe to the coke surrounding the earth plate. The conductor will, therefore, nearly always show a very low earth resistance. Whilst we admit the importance of periodically testing the earth resistance of lightning conductors, we are not prepared to insist on the necessity of a very low earth resistance. We had occasion recently to test the earth resistance of four lightning conductors which varied from one-tenth of an ohm to 160 ohms. Thinking that possibly the high resistance of one of them was due to a break in the cable, we had it dug up. It was found that there was no earthplate at all, simply a few bricks and a little blackish earth, which probably was once a few pieces of coke. Yet this lightning conductor, which was a copper rope half an inch in diameter, had protected a very lofty chimney shaft for over twenty years.

The Proposed Draining of the Zuyder Zee.

THE withdrawal is announced from The Hague, by the newly-formed Dutch Cabinet, of the Bill for the draining of the Zuyder Zee. The Bill had been introduced in the Second Chamber of the States-General by Mr. Lely, Minister for the Waterstaat. Mr. Lely's scheme contemplated the enclosure and the gradual reclamation in part of the Zuyder Zee. He proposed to begin the work with a dam—having sluices opening into the North Sea—from Piaam, in Friesland, to Wieringen, in North Holland. He intended then to reclaim two areas of dry land, or polders: the one, the Wieringen Polder, to extend over a total area of 21,700 hectares, including 18,700 hectares of fertile land; and the other, the Hoorn Polder, to extend over a total area of 31,520 hectares, including 27,820 hectares of fertile land. The two polders would lie between Medemblik and Wieringen, and Marken and Hoorn, respectively. It was estimated that the works would be accomplished in eighteen years hence at a computed cost of 95,000,000 florins, or 7,916,667*l*. The two polders we mention are plotted on the west side of the Zuyder Zee and represent but a portion of its aggregate extent.

Rural Drainage.

THE correspondence on the subject of rural drainage which has been going on for some weeks in the *Times* reveals an unsatisfactory state of things. The extracts, however, from the Reports of the Inspectors of the Local Government Board, which we have published year by year, might well have prepared our readers for this. But it is useless to discuss emendations in the Public Health Act. What is chiefly needed is that the existing law should be strictly enforced, and more especially that the water supply should be kept free from contamination. Parish Councils have power over the water supply of villages, but, speaking generally, they have taken no steps whatever to safeguard the purity of the water of English villages. If every cottage had an earth closet there would be no sanitary difficulties, and even if other systems were properly managed sanitary matters in the English villages would be greatly improved. The local Inspectors are averse to minute supervision, and as a rule, unless their attention is called to some nuisance by an individual or by the outbreak of some disease, they take no steps to keep occupiers up to the mark. In the rural districts in sanitary matters the door is being constantly locked after the horse is stolen. A polluted water supply causes an attack of diphtheria, the local Inspector pronounces a well to be polluted, and an order is made for it to be closed. If such well had been inspected and closed at an early period in the course of a systematic survey of the district, there would have been no outbreak of disease. Common sense and care are the chief needs of English rural drainage. The rural population is decreasing, so that there is not the need for new systems of drainage which are necessitated by the growth of urban districts.

New York Central Railroad Tunnel.

A REPORT has now been made by a grand jury appointed to consider the case of the two-mile tunnel through which the New York Central Railroad approaches its terminal station. The jury recommended that the wall dividing the two outer tunnels from the centre tunnel be removed; that passenger coaches be protected from the sun when not in use; and that some other motive power than steam locomotives be used through the tunnel. We know something of unpleasant conditions in railway tunnels in this country, thanks to the existence of the Metropolitan and Metropolitan District Railway Companies; but even these awful examples serve but inadequately to convey a true idea of the discomfort experienced by passengers in the more trying climate of New York. In other respects public feeling with regard to the Central tunnel in that city very much resembles the ordinary state of opinion in London as to similar conduits. There is, we learn, an "outburst of indignation against a railroad company of which the public has been such a liberal patron,"

and the company is accused of showing not the slightest indication of any solicitude for the comfort of the travelling public. No effort seems to be made to store the carriages in sheds where they could be kept moderately cool, ventilation of the tunnel is conspicuously absent, and the officials, having "expended unlimited time and thought" upon the problem, regret to find that all alternative methods of traction present insuperable difficulties. Up to the present time the Central Railroad has enjoyed something very like a monopoly so far as a certain portion of the traffic is concerned, but the completion of the Rapid Transit tunnel, the construction of the Hudson River bridge, and the introduction of competing roads into Manhattan Island, will no doubt materially affect the position. Then the offending company will speedily discover—as our own sinning companies did—that electric traction is not entirely a philosophical abstraction. Railway companies very frequently resist all reforms that are not dictated by diminishing dividends. This has certainly been the case with our own Metropolitan companies, and the public is now rejoicing to think that the chastening influences of adversity have not been exercised altogether in vain. But our friends in New York have not yet the same reason for self-congratulation.

Trolley Wire Dangers.

THE paper read by Professor Jamieson to the Electrical Section of the Engineering Conference at Glasgow on the dangers arising from trolley wires was a most instructive one. Recent accidents prove that so long as telephone, telegraph, and electric light wires are permitted to pass over the trolley wire, no matter how complicated the system of guard wires adopted may be, there is always the risk of a broken wire making contact between a person or animal and the trolley wire. It seems, therefore, that all message or lighting wires must be placed underground. Doing this would at once dispense with the necessity of guard wires, which are in themselves a source of danger and frequently cause a breakdown of the system by earthing the trolley wire. Sometimes the current carried by the broken guard wire is not sufficient to interrupt the system, and so the hanging wire becomes white hot. Professor Jamieson makes the useful suggestion that an earthing switch ought to be placed on every car, so that in the event of a wire falling over the trolley the driver could, by turning this switch, at once cause the magnetic cut-out of the feeder of that section of the live wire to act, and hence the pressure would be cut off. We understand that this device has been successfully tried at Leeds. It seems to us much the safest and simplest method of procedure in an emergency. We have no faith whatever in india-rubber gloves which are so much in evidence in the rules of traction and lighting stations. We have tested several of these gloves at pressures easily obtainable in the laboratory, and none of the English-made gloves survived the test. The mechanical strength of the gloves also was very deficient, they could easily be perforated or torn mechanically. Hence, we wonder at the confidence that electricians have in them. Earthing the trolley-wire by means of a switch, however, would be a perfectly safe operation, and it seems to us that on a dark night this is the only thing that even the most skilful electrician could do without running grave risks.

The Electric Corrosion of Gas-Pipes.

THE paper which Dr. Leybold, of Hamburg, read at the Glasgow International Engineering Congress, on the "Destruction of Gas-Pipes by means of Electricity," treats of a subject of the greatest importance at the present time. In this country electric traction on the overhead system is being rapidly extended in all directions, and it is well known that large leakage currents from the rails often come back to the station by the gas and water mains. We have very little practical knowledge as to the amount of damage which is being done by these currents, and hence a paper on this point full of practical data will be welcomed by both electrical and gas engineers. An escape of gas in a street of Hamburg was traced to holes eaten away in a wrought-iron gas-pipe which crossed the street at right angles to the tram rails. When the pipe was taken out it was found that there was a hole eaten away directly underneath each of the four tram rails, and nearly all the pipes in the street were similarly damaged. These holes were obviously due to electrolysis. In the cast-iron water-pipes which were laid deeper down no corrosion was detected. The tramway authorities at Hamburg had been in the habit in winter-time of melting the snow on the rails with salt or with waste nitrate of soda. When the ground was soft it got saturated with a saline solution, and any pipes embedded in it got rapidly corroded by electrolysis. To protect some 1-in. gas-pipes they were covered in canvas soaked in boiled tar. On removing lengths of the pipes, however, and unwrapping the covering, it was found that they were corroded, the corrosion taking a spiral form coinciding with the wrapping of the canvas. The author stated that it was highly probable that leakage electric currents in private houses sometimes destroyed pipes embedded in the walls. A clear example of this had recently come to his notice. Knowing as we do the large leakage currents taking place from some of the mains of direct current supply systems, it is of the greatest importance to watch for signs of electrolytic action. In the subsequent discussion Mr. Gisbert Kapp, the eminent German electrician, stated that the Board of Trade "seven volt" rule for preventing damage being done by leakage currents was altogether inadequate. There is no scientific reason for selecting seven volts as the maximum permissible pressure between the rails and the water-pipes. At Hamburg the electricians have reduced the maximum pressure of the rails to much less than this.

The Borough Market.

THE Borough Market Trustees have agreed to effect an absolute transfer to the Southwark Borough Council of all their interest in the market and its profits. But inasmuch as St. Saviour's parish derives from the market rents a sum of 5,000*l*., which is applied in relief of the parochial rates, the trustees are of opinion that the Borough Council should fully compensate the parishioners for the loss which they will suffer through the transfer. The Borough Market, for fruit and vegetables, is one of the oldest in London. It represents a street traffic that was carried on in very early times on London Bridge. After a clearance that had been made in 1290 of the stalls in the roadway of the bridge the business of the market was removed to within the precincts of (old) St. Thomas's Hospital, also to St. Margaret's Church-gate, and subsequently to the main street, there known as "Long Southwark," between the church and the end of the bridge. The Local Authorities suppressed the traffic under powers of an Act they had obtained in 1756; but it was revived by a later enactment in the "Triangle," the former site of Grimes Croft, which William, second Earl Warren, had bestowed upon the monks of Rochester Cathedral, and of Rochester House pulled down in 1604. For some new market buildings, designed by Henry and E. Rose (1851), was demolished the St. Saviour's Grammar School as rebuilt, after the fire of May, 1676, on the site of the prior's house next, south, to St. Mary Overie's. In 1885 plans were prepared by Mr. McIntyre North for a further enlargement of the market by taking in additional ground between Borough High-street and Messrs. Barclay & Perkins's brewery in Park-street, at a cost of about 65,000*l*. Six years ago Mr. A. T. Walmisley was appointed engineer for the construction of a new roof and other works, and Messrs. H. Jarvis & Son made plans for some new covered stands and the flower market.

The Howard de Walden Estate, St. Marylebone.

A PETITION addressed to the London County Council is being prepared by owners and occupiers in St. John's Wood against a contemplated interference with the residential amenities of that quarter of the town. It appears that Lord Howard de Walden, as possessor of what until lately had been the Duke of Portland's estate, is carrying out some extensive alterations and rebuilding in the Portland Town district, to extend over an area of about twenty acres. For re-housing the dispossessed tenants the managers of the estate seek to acquire a site (recently cleared) on the west side of Grove End-road, St. John's Wood. The petitioners represent that the building of model dwellings on that site will seriously affect their enjoyment of a locality which already within the last few years has suffered much through encroachments upon its garden spaces. Moreover, Lord Howard de Walden proposes, as part of his scheme for improving the Portland Town area, to advance the building-line on the front gardens in Park-road to a distance ranging from 10 ft. to 26 ft. The effect of that encroachment upon the roadway which passes along the north-western limits of Regent's Park may be best estimated from what our readers have witnessed during some while past in Euston and Marylebone roads, where what was originally designed to be a broad avenue or boulevard in the former New-road has been gradually destroyed by the erection of buildings upon the forecourts and similar front spaces.

THE STRAND IMPROVEMENT. — Mr. Daniel Watney has published his award arising out of the claim brought by Mr. Davison, silversmith and pawnbroker, against the London County Council for compensation in respect of Nos. 264 and 318, Strand, which were compulsorily acquired for the purpose of the Strand improvement. The experts' valuations on both sides ranged from 8,103*l*. to 27,876*l*. Mr. Watney's award is 16,317*l*.

FURTHER NOTES ON THE BRITISH ASSOCIATION MEETING.

"EDUCATION" has been the subject of a newly-created section of the Association, concerning which it is not quite clear how it comes properly under the category of subjects of an Association professedly formed for "the advancement of science." It rather reminds one of the class of subjects which used to be taken up by the now extinct Social Science Association. Professor Armstrong, who read a paper on "The Future Work of the Section," seemed to tacitly admit that there was no such thing, at present, as a science of education, as he said that "it would be the function of the section gradually to shape a science of education." The superiority of German to English education lay, he said, in the thoroughness with which the work in schools was done, and in the fact that the Germans had made research the corner-stone of their educational system; in other words, that the Germans give more place to science in their educational system than we do; but that is not to say that they have made a science of education, and we fail to see how there can be any such science in the proper and usually accepted meaning of the term. The field which the British Association has to endeavour to cover at its annual meetings, in regard to the subjects which are properly and by universal consent classified as science, is already so immense that it seems unwise to further extend and complicate its programmes by the inclusion of subjects which can only by a stretch of language be said to be scientific. The proper object of the British Association is the study of nature and natural law. We observe also that in the course of the discussion which followed Professor Armstrong's paper all the remarks turned on the methods of teaching science and the inadequate position which science occupied in our educational system. Much of that is perfectly true; only that is not the science of education, but education in science. If there is to be a science of education, it must be concerned with education generally, not education in science alone. In brief, we think the section is a mistake, and that it is wasting some of the power of the British Association by taking on a subject not strictly within its borders.

The subject of the teaching of mathematics occupied more usefully part of the time of the mathematical sub-section of section A. Professor Perry started the discussion in a paper the main point of which was to consider the true use of mathematics as a part of general education. It was usefulness, he said, which must determine what subjects ought to be taught to children and in what ways.

"The obvious forms of usefulness in the study of mathematics were:—(1) In producing the higher emotions and giving mental pleasure hitherto neglected in teaching almost all boys. (2) In brain development (*a*) in mere mathematical study, (*b*) in the aid given by mathematical weapons in the study of physical science, hitherto neglected in teaching almost all boys. (3) In passing examinations—the only form that had not been neglected; the only form really recognised by teachers. (4) In giving men mental tools as easy to use as their legs or arms; enabling them to go on with their education (development of their souls and brains) throughout their lives, utilising for that purpose all their experience. That was exactly analogous with the power to educate oneself through fondness for reading. (5) Perhaps included in (4); in teaching a man the importance of thinking out things for himself and so delivering him from the present dreadful yoke of authority, and so convincing him that whether he obeyed or commanded others he was one of the highest of beings. (6) In making men in any profession of applied science feel that they knew the principles on which it was founded and according to which it was being developed. (7) In giving to acute philosophical minds a logical counsel of perfection altogether charming and satisfying, and so preventing their attempting to develop any philosophical subject from the purely abstract point of view, because the absurdity of such an attempt had become obvious."

He objected to the teaching of elementary mathematics as if all boys were going to be pure mathematicians. He would teach mathematics in quite a different way to different students. In short, the Professor evidently leans towards the use of practical applied mathematics in schools, up to a certain point and for the majority of students. "Mathematics was a powerful weapon with which to unlock the mysteries of nature. If a man" (the average man, we presume) "knew how to use the weapon that was enough. Let him leave to others, the men who delighted in that, the forging of the weapon, the complete study of it." This is only a fresh expression of a feeling which is becoming increasingly prominent at present. There are engineers who hold that, in regard to their studies, mathematics should be gone into just as far as the study bears on the practical problems of their profession, and be taught in direct relationship to, even to some extent by means of, those practical problems. The further discussion naturally introduced the subject of Euclid, who is being somewhat shaken in his seat in connexion with modern education. But we are not sure that some of the arguments used do not cut both ways. Professor Forsyth complained of Professor Perry making usefulness the sole test of the value of a study; subjects progressed not on the line of direct usefulness. Major MacMahon, the President of Section A, followed in the same strain, observing that Professor Perry seemed to look upon every boy as if he were to be an engineer. If they were asked to give up Euclid they must have something to take the place of Euclid, and no substitute for it had been found. "Euclid," he observed (and we entirely agree with him) "was mainly an instrument for the cultivation of the mind, and only secondarily a means of impressing geometrical facts upon students." But he thought it should be taught in connexion with geometrical drawing. Professor Miall, who said he was not a mathematician, but could discuss the subject from the point of view of human nature, thought that if the intellectual needs of the people had been considered in the past, such a book as Euclid's elements would never have been put into the hands of schoolboys. "It was contrary to human nature to put a highly developed technical and artificial system of geometry, complete in all its forms, before a schoolboy and expect him to understand it. The method adopted in teaching should be that by which intellectual activity could produce its own results. It should be exploratory. It should begin with the concrete and put questions on observed facts. Thus was obtained a constructive geometry which every one built up for himself." And as to the question what was to be put in the place of Euclid, it might be observed that in Continental countries they had no Euclid, and had erected nothing in its place. Professor Minchin, following, thought that no satisfactory progress would be made in the teaching of mathematics in this country until Euclid was given up. The stumbling-blocks were the headmasters of the public schools, who would have Euclid. Those who taught mathematics had not yet realised the enormous value of graphical methods.

The point of the whole discussion is really whether mathematics is to be regarded as a mental training or as a means to a practical end. Surely the former is the higher view, and the one most consistent with the broadest interpretation of the word "education." The headmasters of public schools, who came in for Professor Minchin's sneer, are not concerned in teaching boys to be engineers, but in giving them a general education. In this sense the study of Euclid is a fine source of mental training; and we can testify that there are schoolboys, not specially brilliant ones either, who really enjoy the study of Euclid. Sir John Gorst, who occupied the chair and summed up the discussion, charged on the "practical usefulness" side, but appears to us to have unconsciously advanced what was really an argument on the other side. He said he had attempted to teach mathematics to Maori boys and men in New Zealand; he proceeded on the embryo Sonnenschein system, and found that the Maoris learned the practical arithmetic useful to them in active life faster than boys or men in this country would generally learn it, but when he attempted to teach them geometry after the Euclid fashion, it was an absolute failure; not one of them could grasp or understand the simplest proposition of Euclid. Naturally so. These Maoris were, if not savages, only just emerging from the state of savage life; and it is the characteristic of the savage mind as distinguished from the civilised, that it can only take in what presents itself as a concrete and practical object. Are we to reduce the system of teaching in our schools to the level of what can be taken in by the barbarian mind? The object of teaching the Maoris, and the only object, evidently, which they could understand, was to give them what is called useful knowledge. The object of general education for a cultured people is not merely "useful knowledge," but the development and training of the intellectual powers as an end in itself; and in that respect we think Euclid will still maintain his place. The general tone of the discussion of the subject at the Association we should call sadly utilitarian, and recommending a view of education which tends to narrow rather than to develop the intellect.

The Geology and Chemistry Sections were not for the most part occupied on any subjects having a bearing on those in which our readers are concerned. In the Chemistry Section a paper was read by Mr. Beilby on "The Minute Structure of Metals," but we have seen no report of it beyond the title. In the Geology Section Dr. R. Logan Jack read a paper on "Artesian Water Supply in Queensland." The western area of Queensland, like other portions of the Australian continent, offers a vast area of land fit in itself for cultivation, but deficient in rainfall and in surface water.

"* In 1881 he suspected that the cretaceous rocks of the Western Downs afforded conditions favourable for the discovery of artesian water, and in 1885 he, as Government geologist, with Mr. J. B. Henderson, hydraulic engineer, made a study of the area, and an experimental bore was put down which proved a success. From Mr. Henderson's annual report for 1899-1900 it appeared that up to June, 1900, 185 miles of boring had been made in search of artesian water in the district, and a large proportion of the bores had been successful; and though the artesian water did not fully compensate for the lack of rain, still the bores had already produced an important change in the conditions of life in the interior. The greater part of the western interior of Queensland was composed of soft strata of lower cretaceous age, consisting of clay-shales, limestones, and sandstones. Along the eastern margin of the cretaceous area there was a porous sandstone of great thickness, the 'Blythesdale Braystone,' and owing to low dip the outcrop of this permeable stratum occupied a belt from five to twenty-five miles wide; but the Braystone finally disappeared beneath the argillaceous and calcareous upper members of the series forming the surface of the downs to the west. Several rivers disappeared while crossing the outcrop of the Braystone, and the water must be carried in it beneath the clay-shales of the downs. Dr. Jack gave an estimate of the water which should penetrate the Braystone, and suggested the probability that much of it finds an outlet under the sea in the great Australian Bight and the Gulf of Carpentaria. He further observed that the artesian water basins were, in fact, broken basins, the break giving rise to leakage either on land or beneath the sea. In places, therefore, the water rose in a bore, but did not reach the surface owing to the site of the bore being higher than the head of pressure. This was termed 'sub-artesian water,' and illustrations were given of both artesian and sub-artesian water in the district in question."

In the Mathematical and Physical Science Section Dr. Glazebrook read a paper on the new National Physical Laboratory in course of erection at Bushey, of which he is superintendent, and about which we gave some brief particulars in our last issue. He exhibited the plans of the building, and gave the following description of its construction and arrangement:—

"The main building consisted of a substantial central block about 70 ft. square, standing on a vaulted basement. At each corner there was a large wing practically single-storied; the rooms in these were being fitted up for various special purposes. In the central building itself would be two general laboratories. There would be a large entrance hall, arranged as an apparatus-room, and a library. The basement contained six rooms of fair size; the floor had been covered with a thick layer of concrete. The walls were very thick, so that they were extremely steady, and the temperature and conditions all favourable for steady work. In addition there were other smaller rooms on the basement; two of these were entirely surrounded by thick interior walls, and arrangements would be fitted to maintain a steady temperature throughout the year. At the back was another wing containing a number of rooms suited for special researches, and there a lift had been fitted, and also a mercury column having a height of about 50 ft. For the more delicate physical work the ground floor and basement of the old house afforded ample accommodation. For the engineering work a room, 80 ft. by 50 ft., had been built, lighted from the north by a weaving shed roof. It was divided longitudinally into two bays by a series of rolled steel pillars. The one bay would contain a light travelling crane; along the other ran a line of shafting for driving the machinery and for experimental purposes. Adjoining this laboratory was a drawing office, while the engine-house and boiler-rooms were close at hand. Power, obtained from a 60-kilowatt Parsons turbine, would be distributed electrically to various

* We quote, as before, from the *résumé* published in the *Times*.

parts of the laboratories; this form of engine was chosen for the express purpose of avoiding vibration as far as possible. The necessary tools were on order and in course of installation. The work which the committee hoped to attack in the first instance was that which had already been under the consideration of the Alloys Research Committee of the Mechanical Engineers. Apparatus for the photo-micrographic examination of steel rails was being set up, and machines for testing the elastic properties of alloys were in course of construction. Pressure gauges and steam indicators would also be tested. The height of the building would not allow the mercury column, now being erected, to measure more than 200 lbs. to the square inch, but apparatus was being constructed for pressures in excess of that amount. Considerable attention was to be given to high temperature thermometry, the testing of platinum thermometers, and the measurement of electrical quantities. Before the end of the year the committee hoped the laboratory would be fully and usefully occupied."

In the Physical Section a report was presented by Professor Everett on the subject of the rate of increase of temperature at distances below the surface in various localities. The results stated are somewhat surprising in regard to the variability of the rate of increase of temperature. Mr. Alfred C. Lane, the Michigan State Geologist, in the absence of more precise information, estimated the mean annual temperature for the district in question at 38·6 deg., and the mean temperature at the depth of no variation at 40 deg. Fahr. If we took this latter as the temperature at 50 ft. and compared it with the temperature 84 deg. at 4,450 ft. (the admitted temperature at that depth), we had an increase of 44 deg. Fahr. in 4,400 ft., or 1 deg. in 100 ft. Mr. Lane's estimate for the Calumet district, where these mines were situated, was 1 deg. Fahr. in 107 ft., and he stated that a gradient was indicated of between 1 deg. in 100 ft. and 1 deg. in 115 ft. No authorities were cited for the conductivities which Mr. Lane assigned to the rocks, and fuller information on this point was desirable; but in view of the fact that the variation in the British Isles from 1 deg. in 34 ft. to 1 deg. in 92 ft. had been characterised as a surprising divergence of extremes from the mean, it was well to emphasise the connexion between gradient and conductivity. At a deep boring in Upper Silesia, the deepest in the world, the highest temperature at a depth of 1,959 metres was about 157 deg. Fahr., and the average increase 1 deg. Fahr. in 62 ft.

The crack-brained persons who, like the Sultan in *Don Juan*, deny that the world is round, because it appears flat to their senses,* might find some interest in the account communicated by Mr. Yule Oldham to the Geographical Section of his and Dr. Wallace's photographic object-lesson in regard to the earth's curvature. They selected for the demonstration a straight six-mile stretch of the Bedford River, between Welney and Denver, where there was a bridge at each end and an uninterrupted length of river between. The height of the parapet of one bridge from the water level was measured, and a mark at the same height set up on the other bridge, and an intermediate mark on a pole, at the same height above water level, at a distance of three miles from each bridge. A telescope was then directed along the line of sight from the parapet on one bridge to the mark on the other, and the intermediate pole mark was seen about 6 ft. above the line of sight. The result, obtained by means of telephotography, was shown on the screen. Sane persons do not of course need such a proof; but considering how completely such a stretch of river would impress the eye as level, there is an almost dramatic effectiveness in having its curvature illustrated in this manner. And if this should meet the eye of the surveyor who once wrote to us to ask "whether the line of sight of a telescope was a straight line in space, or a line following the curvature of the earth,"† it may also serve to clear his mind and that of any others whose wits are similarly befogged.

In the Anthropology Section Mr. J. L. Myres, Mr. Hogarth, and Mr. Arthur Evans described the recent archæological discoveries in Crete; but with these our readers are already well acquainted.

In the Economic Science and Statistics Section the subject of the housing of the poor and working classes was the subject of an animated discussion. It is difficult to see exactly how this subject, any more than education, comes properly under the head of "Science," but one need not quarrel about nomenclature if any assistance is given towards clearing up such a problem. The subject was started by a paper by Mr. A. L. Bowley on Glasgow wages in the nineteenth century, of which we have seen no report. Professor Smart opened the discussion by some remarks full of common sense, but only embodying the opinion at which, we imagine, all thoughtful persons who have studied the subject have arrived, viz., that it was dangerous and inimical to private enterprise if a municipality undertook housing on unremunerative terms; that the question ought to be made clear whether it was the poor or the working classes who were to be housed; and if the former, it should be recognised as a form of poor relief. And if the working classes were to be housed on any terms short of being remunerative, it was an indirect subsidy, and the deficiency was borne by the ratepayers. He also suggested that where local bodies took action in regard to housing their accounts should be open to inspection. Mr. Peter Fyfe, a sanitary inspector, and presumably taking up the cause of the Glasgow Corporation, said he did not think the housing of the poor necessarily involved loss. Defining the poor as those who earned not more than 25s. a week (which is perhaps putting it rather high), he thought they could not be housed without municipal help. There should in the case of loans be a differentiation of the sinking fund from the interest of capital. The sinking fund ought not to be paid for by the rents—for land was not depreciated by time. The rent ought to be only interest and allowance for depreciation of the buildings. Buildings under good by-laws would last 100 years. In his opinion, the sinking fund might be allowed to be repaid in 100 years instead of forty or fifty years. Mr. McBain thought the Improvement Trustees of Glasgow had by no means solved the problem; they had lost a large sum, and no proper account had been taken of the heavy cost of repairs; and if the rents were to be such as Mr. Fyfe proposed, the sanitary requirements of municipalities made it impossible for private persons to build houses for the poor. This is a complaint that has often been repeated, and the necessity for demanding solid and sanitary building no doubt adds to the *crux* of the problem; but it is not the less a necessity for all that. Mr. McBain went on to assert that these cheap houses at small rents were constantly occupied by people who could afford better rents, and who spent the surplus in drink. The Lord Provost declared that the Corporation never built to lose; they had been obliged, however, to go further out of the town; and he admitted that they had not yet tackled the problem of the lowest class. No special decision or resolution on the subject seems to have been arrived at.

In the midst of these sober practical questions, concerned with the life of man and the study of natural phenomena on this planet, Lord Kelvin made on the Tuesday a kind of meteoric appearance in a brilliant address soaring into the region of speculative and cosmical science, the ostensible subject being "The absolute amount of gravitational matter in any large volume of interstellar space." Here we come again on the question of the structure of the Universe—the greatest of all structural questions. Lord Kelvin's address was, we understand spoken, not read, nor did he furnish any written *résumé* for the Press; and as he habitually speaks with a characteristic rapidity of transition from one point to another, we question whether the published reports quite correctly represent on all points, what he said or meant to say. He does not seem to have kept very directly to the nominal subject of the paper. This seems to have been touched, and almost immediately abandoned, at the commencement only of the address, Lord Kelvin drawing a distinction between "matter" simple and "gravitational matter," instancing the presence of ether as a proof of the existence of matter outside the limits of gravitational influence. Considering that ether has hardly advanced to more than the condition of an assumption, one can hardly regard this in the light of "proof:" but we can accept the reasoning that if there is ether it must be imponderable, on the ground that if it extended to all space it could not be subject to gravitation, because in that case its condition would not be stable. After all, "ether" seems to be little more than a new name given to what used to be called "space," in order to save us from the necessity of trying hopelessly to imagine absolute vacuum. But Lord Kelvin said that he had no wish to discuss ether and its peculiarities ("peculiarities" is certainly good of a substance of which we are only postulating the mere existence), but he was rather concerned to show that our universe, meaning thereby (as indeed we should naturally conclude) not the solar system, but the wider space from which the light of the most distant star could reach our telescopes, "was a small affair." The old sin of speaking disrespectfully of the Equator was nothing to this; but Lord Kelvin means that it is within the grasp of thought and of mathematical expression. The space or sphere (assuming it to be spherical, which was not necessary) which he would consider could be expressed very easily in mathematical language, and he would express it by $3{\cdot}09 \times 10^{16}$, a number which would express the number of kilomètres in the radius. This distance was selected because a star situate on the boundary of such a sphere would have a parallax of a thousandth of a second, "or the distance of the sun from the earth would subtend an angle of that amount at that distance." Surely Lord Kelvin must have said, not the distance of the sun from the earth, but the diameter of the earth's orbit. We do not take parallax angles from the sun, as we cannot get there; the received base for the parallax angle of a distant star is the diameter of the earth's orbit—in other words, observations at intervals of six months, affording the longest base practicable to mortals. What follows we quote in the words of the *Times* report, with the exception of correcting an obvious mistake therein of "mètres" for "kilomètres":—

"If the radial force were equal over the whole spherical surface its amount could be expressed as a small but definite fraction of terrestrial gravity, and that every body on or near that surface would experience an acceleration towards the centre, which in the ordinary notation of kilomètres per second, per second would be expressed by 1·37, divided by 10 raised to the power of 13. The velocity acquired per year would be the millionth part of 4·32 kilomètres. In five million years the velocity acquired would be 22 kilomètres a second, if the body started from rest at the spherical surface, and the space traversed would be about one-twentieth of the imagined radius. In 25,000,000 years the velocity would be 108 kilomètres per second, and the distance covered, expressed in kilomètres, would be 4·25 multiplied by ten to the power of 16, or more than the radius of the sphere, which showed that the rate of acceleration could not remain approximately constant for 25,000,000 years. If the system were started at this remote distance of time, the stars would have had the opportunity of acquiring velocities either more or less than the critical velocity of 108 kilomètres, here given, and this velocity agreed with the measured velocity in the cases of stars like *a* Centauri and 61 Cygni, and was not greatly different from the velocities in the line of sight determined by the spectroscope."

This is a curious and almost startling concurrence of observed phenomena with the result of abstract reasoning; unless indeed Lord Kelvin consciously or unconsciously marshalled his mathematical argument up to the known rate of movement revealed by the spectroscope. Then followed the consideration of the probable distance of stars from each other. He was more inclined to assume the existence of 1,000 million such bodies in the assumed space than Professor Young's 100 millions, but nine-tenths of them might be dark bodies, or dark to us (for a reason which appears at the close of the address). If the stars (this postulated number, we presume) were arranged exactly in cubical order, the six nearest neighbours to any sun would have a parallax of $\frac{6}{10}''$; this distance expressed in kilomètres would be about 50×10^{13}. Here we do return again to the nominal subject of the lecture, and Lord Kelvin proceeded to illustrate the question by increasing the possible number of suns and decreasing their size, till, if they were reduced to one centimètre in diameter, the proportion of space occupied to that vacant would be as 27 to 1,000; but we question whether these reported figures can be correct; the proportion of matter to vacancy seems much too large in comparison with the initial statement as to the distances separating the original suns; but we have not had time to attempt following out and checking the figures arrived at. The centimètre suns were

* We had a correspondent who used annually to send us letters and supposed demonstrations on this point, praying for their insertion in our columns. His decease alone put an end to his pertinacity.

† A fact.

then reduced to the size of molecules, and a consideration followed as to the extent of free path each of these could have without coming in contact with a neighbour; a matter of mathematical analysis. The figure reported seems enormous—10,000 million kilometres, and we can hardly think it can be correct. The question has of course an important bearing on the nebular hypothesis, a point which was evidently discussed by Lord Kelvin, but not reported. Finally he came to the consideration of the effect of the appreciable time required by light to traverse space. There was irrefragable evidence to prove that the life of our sun as a luminary was but a moderate number of million years—he would put it at fifty million. "The time taken by light to travel from the outlying stars of our sphere would be about 3¼ million times the life of such a star"; and this in a universe which Lord Kelvin calls "but a small affair." We conjecture there is some mistake in that "million." The light from the nearest fixed stars is estimated, if we remember right, to take twenty years to reach us. To give the furthest such an unimaginable time for light-travel seems disproportionate, unless the universe—"our universe," as Lord Kelvin calls it—is to be regarded as practically infinite, an idea which he discountenanced at the outset. Did he not say "3¼ times" the life of the star? That would give us an allowance of about 162 million years for the light travel of the outlying stars. It seems a sufficient conception for a universe which is "but a small affair." The result even in this case is that all the existing stars would never be seen together; for them all to blaze on us at once they would have to be set alight at earlier and earlier periods as we progress outward from the centre to circumference; the earth, for the purpose of this argument, being the centre.

Such calculations and such times and distances, though expressible in figures, are hardly within the grasp of mental realisation. Nevertheless, such speculations serve to lift us above the common and prosaic realities of life; and perhaps it is not the least wonderful part of the subject, that beings who are materially confined to this almost infinitesimal point in the vast ocean of matter, should have the capacity to deal in

"These thoughts that wander through eternity."

At all events, Lord Kelvin's brilliant address was the most remarkable feature of the Glasgow meeting. One cannot but be amused however at the naïve manner in which Dr. Schüster, who seconded the vote of thanks to Lord Kelvin, asked "What was the state of the universe at creation? Were the atoms spread out uniformly or scattered in groups?" It would seem from this that Dr. Schüster has a mind able to conceive the nature of "creation" and the existence of a prior nothingness or nonentity before creation. If so, his brain must be intrinsically superior to that of ordinary man. We may use such words as "creation," but neither the idea of that or of previous non-existence of time or space are thinkable by the human mind.

Illustrations.

TERRACE GARDENS, FOOT'S CRAY PLACE, SIDCUP.

THIS illustration forms part of the second edition of Mr. Mawson's "Art and Craft of Garden Making," which was reviewed in our issue of August 24, wherein is a full description of the house, site, and surroundings pictured in the above illustration.

With the intent of redeeming the gardens from the state of partial neglect into which they had fallen through unoccupation, Mr. Waring, the owner, called in the assistance of Mr. Mawson, who, together with his colleague, Mr. Dan Gibson, after due calculation of the rise and fall of the land, prepared a complete scheme which can be carried out partially or wholly, as deemed desirable, a portion of the work being now in progress. The illustration shows the suggested terracing to the immediate front of the house, the central steps of which lead down to a characteristic beech avenue to the lake.

The idea, as will be gathered, has been to give this house a stately setting in harmony with its architectural style.

"STEEP-HILL," JERSEY.

THIS house occupies the site of an old one; it is set in a typical Jersey garden. The whole of the exterior is rough cast; the roofs are covered with deep red hand-made tiles. The porch is of rough grey granite, with cast lead gutter and semi-dome. Inside, the drawing-room, hall, and library are panelled, the former with deal painted and the latter with oak. The staircase is also of oak.

The plaster ceilings of hall, drawing-room, and library are the work of Mr. Bankart.

The general building and all the joiners' work were contracted for by Mr. Crill, of Jersey.

Mr. Reginald Lloyd, architect, of Jersey, supervised the whole of the work on the spot. The plan and design are by Mr. Ernest Newton. The drawing was exhibited at the last Royal Academy.

DESIGN FOR A MEMORIAL BRIDGE.

THIS sketch is the embodiment of a passing idea, and does not claim to represent a worked-out scheme. The following facts, however, gave rise to it:—

An additional bridge is needed across the Thames between Waterloo and Blackfriars, east of Somerset House, and could be well placed to connect with the eastern spur of the new Holborn to Strand thoroughfare.

This bridge should be much wider than other London bridges, with aisles for slow traffic.

No finer sight, for sight-seeing purposes, could be procured in London now than the centre of the river, at a point around which the great Embankment radiates, flanked by the groups of Somerset House and St. Paul's. A grand memorial arch planted midstream astride the bridge would connect tide and road, and perhaps be an architectural embodiment of the fact that the British Empire is firm rooted in maritime power. BERESFORD PITE.

LEICESTERSHIRE SOCIETY OF ARCHITECTS.

THE following is the address given to the members of the Leicestershire Society of Architects, on the 14th inst., by the President, Mr. S. Perkins Pick. We omit a few introductory words referring to matters of local interest:—

It has occurred to me that this would be an opportune time to say a few words chiefly to the younger members of that body who have taken up architecture as a study and pursuit in life.

All those who take a keen interest in the arts must necessarily be students always; the subject itself is inexhaustible, and the variety of it boundless; it may further be said that the pleasure derived from a knowledge sufficient for the appreciation of fine work, whether displayed in a building, a picture, a piece of furniture, silver, glass, or any other object, is indeed very great. Even this alone ought to be some compensation for the energy and exertion which it is necessary to show in order to obtain sufficient knowledge to reap this advantage; but then there is also that serious responsibility which comes to architectural students a little later on in life of spending other people's money upon work which may be altogether unworthy. The thought of this ought also to make each one of us determined to leave no stone unturned which may lead to better results. To do good work a great amount of care, thought, knowledge, and ability is requisite, and the importance of architectural students acquiring a proper knowledge of the grammar of their calling cannot be overrated. Those who trust to Providence and chance and spend their studentship days listlessly will in days to come have a poor chance of success. Many of our clients—and it is a pleasure to add that they are an increasing number—have a good knowledge and excellent taste in architectural matters. In not a few instances their judgment on buildings, furniture, and decoration is undoubtedly better, and is therefore preferable to that of quite a large proportion of architects who are practising the profession for a livelihood. This ought not to be. Architects should give their art a first place, and their chief aim should be thorough efficiency in this before all things. One hears of, and even knows of, architects who are really geniuses in matters outside their professional calling—men who are extremely clever in quite a variety of ways other than their own, by which is meant other than those which the brass plate at their office door indicates as the mode by which they expect to earn their livelihood. There are instances in which it almost amounts to obtaining money under false pretences, so little does the work of such men justify their existence as architects. But pray do not misunderstand me. We must all have a high opinion of the genius who is capable of doing many things well. We know that there are men who are extremely versatile, and who can do many wonderful works of great variety: It is not to these that reference is made, but to those who make specialities of many other matters rather than their own calling. In other words, there is a strong feeling and desire on the part of all right-thinking persons that men should first be geniuses at their own work, and that other accomplishments should be of secondary importance. Possibly more need not be said to those who have selected architecture as a pursuit in life about the advisability of making architecture and the allied arts their first consideration, beyond this, namely, that the number among the public who have a good knowledge of architecture is rapidly increasing, and it is absolutely necessary, if we as architects are to retain our position as advisers in the matter of architecture, that we should obtain sufficient knowledge and good taste to justify our existence as such.

To obtain this knowledge is really a huge problem, and the earlier we realise this the better for those who venture hereafter to place their confidence in us, and, indeed, the better for ourselves also. To you as students it should be pointed out that the grammar of your work must be acquired very largely in the beginning of your career as pupils; indeed, if the elements are not learnt at this period, it is doubtful if they ever can be attained in after life. Take, for instance, such a subject as the bonding of brickwork; it never is, and cannot be, properly taught in an architect's office, neither can all the practical methods of plumbers', carpenters', stonemasons', or iron-founders' joints, and a thousand and one other technicalities. Then, again, how can the ordinary pupil obtain a proper knowledge of the history of architecture, or of ornament in the ordinary routine of an architect's office? What can he learn there of light and shade, advanced drawing, and more particularly of modelling, and the crafts generally? It doubtless is well known to every one of you that knowledge and accomplishments of this character are not, and cannot be, acquired in an ordinary architect's office. There must, therefore, be found some other solution of the difficulty, and what have we better, or more suitable at any rate, at the present time in this country than our schools of art.

To those architects who take pupils it should be pointed out that they have a duty devolving upon them of a serious nature which is not always properly realised. In a great number of cases the pupil is admitted by the payment of a premium; he is allowed the free run of the office, but beyond this no particular instruction is given, or special care taken, or facilities offered, by which he may attain a proper knowledge of architecture and building. He is, as a matter of fact, generally left to his own resources, and it amounts to a chance whether the pupil fails or succeeds. All this is much too casual. Would it not be desirable and wise to make it a condition that architects' pupils during their articles should spend, say, not less than two days, as well as three evenings, a week in some such institution as this School of Art, and could not more facilities be given for sketching and measuring old work and for study of building works in actual progress? If the student is one whose heart and soul are in his work, and he is imbued with a craving for the knowledge and love of fine work, it matters not so much whether any curriculum is provided for him or not; in fact, there are cases where the so-called natural bent of the industrious student—that rare genius one sometimes hears about—has been rather harmed than helped by it, but even these very rare young men must have facilities for study, and where are they likely to find better materials, at any rate in the provinces, than in a school such as this? Think, too, of the advantages of meeting other students for an interchange of opinions—how one's pet ideas get shot at and hard hit by the competing genius who possibly does not accept the ideas of his

brother student, and who probably may have quite opposite dreams and fancies of his own of realising an architectural Utopia in some dim and distant future; and, again, what a grand thing it is to make endeavours to lay that "ghost" which appears and disappears with almost the regularity of the moon, viz., "a new style of architecture!"

Let us pause and ventilate our views on this subject, which is always a fascinating one for us. Speaking broadly, with reference to this matter, it may be said (and in my opinion it is so) that there is a great deal too much striving after this phantom of a new style of architecture. It is a delightful thing to have dreams of all this, but there is nothing more dangerous than to endeavour to realise them in solid material. It is not intended to convey by this that you should not aim at originality, but that you should first know and realise the true principles upon which good work has been done in the past, and the altered conditions necessary in a building of to-day. Generally you will find that modern requirements have so altered that by the time you have provided the accommodation required, and got your materials together, there are quite enough new elements in the problem to make it impossible to reproduce any style of old work. And while upon this subject of originality it may be as well to point out that the most original work now being erected is that carried out by the speculative builder and the mediocre architect. Men like Mr. Norman Shaw, and Mr. T. F. Bentley, and Mr. John Belcher, although among the best architects now living, are not anything like so original in their buildings as are the ordinary claptrap architect and speculative builder whose work is so generally prevalent. Does it not occur to you that leading architects of the type mentioned are possibly among those who have a greater knowledge of precedent, have drawn and made a study of old work to a greater extent than most other practising architects? There does not appear in their work any great effort to be particularly original; indeed, it is generally the omission of this which makes their buildings so scholarly and suitable. There is no attempt on the part of such men as these at that drastic measure one sometimes hears of, namely, the smashing up of the styles; but, unfortunately, one too often sees specimens of that by men of smaller attainments; and there can be no discord in music made more trying to the nerves of a fine ear than are the results of some of the attempts at architecture made by these smashers up of the styles. It is quite as essential that a building should be in key and tune, so far as style goes, as it is for the various instruments in an orchestra, that is to say, if there is to be any resultant pleasure to those who have an eye for colour or an appreciation for good composition and form. There is nothing more dangerous to architecture than this craving after something entirely original and new, and we are suffering almost as much from the unrest caused by it as from the lack of education to which reference has already been made. Some short time ago, when discussing the question of harmony in architectural design, a friend retaliated that he disagreed with me entirely, and pointed out that in the finest pieces of music discords were often introduced with great effect. My answer to that is, that these discords could only be used by the musical genius, and, as a matter of fact, it is believed are chiefly used by them to give additional value to the harmony which precedes or follows the discord. A similar discord may be, and often is, introduced by the architectural genius, but here again it is done to give some additional value to the surrounding work.

The argument is this, that music consisting entirely of discords cannot give pleasure to a sane and educated musician. Neither can a building consisting of numberless features out of harmony with each other satisfy the eye of an accomplished architect. The whole question may be summed up by stating that a genius may do daring things and be successful, where the mediocre person will ignominiously fail.

The moral which should therefore be pointed out is "Do not attempt to be too clever." The result of all these attempts at so much originality generally ends in but a poor mediocrity or something worse which ordinarily goes by the name of ugliness.

Well, now to return to the main subject which it is my chief anxiety to lay stress upon, namely, the education of our students in architecture. This is probably one of the most important matters that we can possibly discuss. Some learned men have suggested that it is the public who need education in building and architecture, and not those who practise it as a profession; but my view is that it is the architect who needs looking after, for whatever may be the knowledge, and love, or desire on the part of the public for really fine work, it cannot be of much avail unless architects have the necessarily superior knowledge to satisfy the yearnings of those who wish for something better than what generally prevails. And besides, one's own experience of those of the public who practise amateur architecture is that they never know, and in fact cannot know, sufficient of the subject to justify them in directly giving instructions in building operations. It has been already pointed out that many of the public have a very keen appreciation for good work; the erection of a building is, however, much too complicated a business for any amateurs to ever gain a sufficient knowledge to justify them in being their own architect. Some of us have been told by a client as a preliminary when further building operations have been contemplated to his premises, that for certain buildings which are often pointed to with evident satisfaction, "I was my own architect for that." Well, gentlemen, it is perhaps needless to tell you that this information is generally needless, for the work usually proclaims that lack of knowledge which is the hall-mark of the amateur. On one occasion a client made use of this expression to me, and the quality of the work was surprisingly good. It was rather difficult to understand, but the secret came out when I asked the amateur architect who made the drawings: "Oh," said he, "Mr. So-and-So did that, but they simply embrace my own ideas." Possibly that may have been perfectly true, but nevertheless that amateur architect would not have had so good a result without the assistance of Mr. So-and-So, who must have very cleverly put these so-called "own ideas" in such a form that the builder was enabled to erect a very satisfactory piece of work. It occurred to me that this gentleman, who prided himself in being so clever when acting as his own architect, was very lucky to have found such an excellent ghost to do the actual work; particularly so when it is realised how scarce and difficult it is to find the genuine article.

It is no pleasure to speak to you in a disparaging manner, but it is advisable, especially on an occasion like this, to be candid and honest when speaking on a subject which is of the greatest importance to all of us. The regret with which it is said does not alter the fact, namely, that a very large proportion of architects' assistants cannot even draw decently, much less design a passable moulding or a creditable cottage. Surely there is something wrong in this. What good result can be achieved by such men in work like architecture, if they are incapable of even properly putting any ideas they may have in a sufficiently intelligible form for a tradesman or craftsman to be able to execute the work therefrom? As an opposite illustration, let me call your attention to those, the minority of students, who are capable draughtsmen; does it not occur to you that they are also the most capable designers as well? And is it not within your own knowledge that these men are those who have been enthusiastic workers in our Academy schools, Architectural Association classes, and our schools of art? It does not appear to me necessary to labour this matter, because it must be so well known to you. Therefore, why are there comparatively so few students from architects' offices in Leicester who attend here to improve their knowledge, and to gain that facility, power, and judgment which are so imperative for their work? Is it that students have recently received so much conflicting advice from various enthusiasts, one insisting that they must be first and foremost men of science, another that they must be artists pure and simple, and still another that they must be craftsmen and not draughtsmen; all this resulting in students giving up the whole thing in dismay at the multitude of advisers and the disparity of advice offered by them? Or is the reason to be found in that lack of interest and earnestness which are so absolutely essential before good work of any kind can be achieved? It is rather to be feared that the latter is more likely to be the correct interpretation of the reason why all architectural students do not accept opportunities which are not only offered, but really pressed upon them in these days. Perhaps it ought to be pointed out—and, indeed, it is a pleasure to do so—that we in Leicester are not worse off than the profession in other towns and cities of a similar size.

Indeed, we are assured that the proportion of promising and industrious men is probably larger in our own town than in many other towns, so that the foregoing remarks may be considered as superfluous and possibly unjust. One is quite aware that we have a minority of young and rising men who have acquitted themselves admirably, and who doubtless will in the future do work of a highly creditable nature, and will help to make the Leicester of the future a more interesting city than the town of Leicester to-day. You will probably forgive me for mentioning as an instance the name of our friend Mr. Shirley Harrison, whose power as a designer and draughtsman is very great, and who a very short time ago came out the Ashpitel Prizeman, being the first man of his year at the Associate Examination of the Royal Institute of British Architects. And as another instance, it is a pleasure to mention the name of Mr. Albert Herbert, whose all-round knowledge and refined tastes are quite exceptional; he also distinguished himself at the same examination on a previous occasion by gaining the "Arthur Cates Prize."

There are others among us who have shown improving powers, and some who, Mr. Fletcher assures me, have unquestionable faculties which only need application on the part of the students to make real and rapid progress. But a regret remains, and that is the small proportion of the total number of architectural students who show that rare power and perception to which reference has just been made.

Probably some of you may say that all these exceptional students belong to that select class known as "the heaven-born genius," and indeed it may be admitted that they have some special brain faculties, but you may be quite assured that the most precious gift they possess is the aptitude for intelligent industry, which, properly applied, creates a love of fine work; and when once a student has arrived at the stage of having an appreciation of good work, it is fairly safe to conclude that he will in the future do creditable work himself. No man is actually born with a knowledge of architecture, painting, sculpture, or craftsmanship of any kind. And no man achieves success in any such work without a long and constant intelligent application.

Those students who either cannot, or will not, make the effort to attain a proper knowledge of their work by the necessary sacrifices which the process entails, should give up the idea of being architects or artists; and the sooner the better, not only for themselves, but for the rest of the world.

EXHIBITIONS AND SCHOLARSHIPS IN ART.

THE Board of Education have awarded Royal Exhibitions and Scholarships to the following teachers, students, &c.:—

Royal Exhibitions.—Helen M. Pike, art student-Edinburgh; Arthur W. Pope, art student, Nottingham; Horace Wooller, art teacher, Brighton; Walter S. George, architect's assistant, Ashton-under-Lyne; Charles H. Broughton, art student, West Bromwich; Richard R. Goulden, art teacher, Dover; James A. Stevenson, art student, Chester; Nathaniel Sparks, art student, Bristol; Frank Marlow, art student, Leicester; and James P. Samuel, lithographic artist, Aberdeen.

Local Scholarships: Arthur E. Fowkes, art student, Leicester; Harold A. Rigby, art teacher, Preston; Harry C. Hall, art student, Sheffield; John B. Piercy, art student, Chester; Jessie Kilpin, art student, Leeds; Mary G. Tutin, art student, Nottingham; Frank Gatter, art teacher, London; Peter Mitchell, art teacher, Galashiels; Joseph N. Sanders, art student, Birmingham; Mabel Thatcher, art student, Bristol; Charles Haworth, art student, Liverpool; Ernest Collins, art student, West Bromwich; Ethel Cliff, art student, Leeds; William G. Spooner, art student, West Bromwich; John B. Godson, art student, Leeds; James J. Grant, art student, Aberdeen; Frederick N. Smith, art pupil teacher, Bridgwater; Ethel K. Pitt, art student, Bristol; Albert H. Greenfield, art teacher, Brighton; and Ellen Hill, art student, Bradford.

A Royal Exhibition is tenable for three years, and entitles the holder to free admission to the Royal College of Art, London, or the Metropolitan School of Art, Dublin, for the session of

about forty-two weeks each year, and during that time to a maintenance allowance of 25s. a week and third-class railway fare for one journey to and fro, each session, between the home of the exhibitioner and London or Dublin. The Royal Exhibitions are held on the condition that the exhibitioner regularly attends the course of instruction laid down for him, complies with the rules laid down for his guidance, and makes satisfactory progress. The allowance may be withheld or reduced in the case of a student who fails to attend as prescribed.

A Local Scholarship is tenable for three years, with a maintenance allowance of 20*l.* a year, at any School of Art under the Board which is open at least three days and five nights a week, and which will remit the fees for instruction of the holder. The scholar must attend a School of Art during at least forty weeks in the year for thirty hours each week, of which eighteen hours at least must be in day. The scholarship commences on the date at which the school where the scholarship is tenable re-opens after the summer vacation in each year. The maintenance allowance is paid quarterly, on the receipt of a certificate from the Master and Secretary of the School of Art that the scholar has attended regularly and pursued his studies satisfactorily.

COMPETITIONS.

MARKET HALL, LLANRWST.—A competition for a new market hall, &c., at Llanrwst, in North Wales, has just been decided. The successful design is for a building of Penmaenmawr granite, relieved with Yorkshire stone dressings, and was sent in by Mr. E. Grubb, of South Shore, Blackpool, to whom has been awarded the premium of 20*l.* There were twenty competitors.

RUSSIAN TIMBER TRADE.

THE question of the partial exhaustion of the timber supply is briefly and lightly touched upon in Mr. Consul Woodhouse's Report to the British Foreign Office on the trade and commerce of the Riga district. He remarks that one broad fact as regards the wood trade of the world in general is ever before us. It takes from sixty to seventy years to grow an average convertible tree, and two minutes to hew it down. Thus each year the supply of timber is diminished, the forest fringe recedes further and further from the ways and means of transport; each year the expense of working out the forests is increased by the extra distance the logs have to be carried. Then, owing to the nature and manipulation of the trade, consumption and supply cannot keep pace with each other; one is continually catching up the other, and the consequences are rises and depressions. But in the opinion of all who know anything about timber, and have studied the great question of supply, there must be a steady increase in the price of every description of wood goods, and each flood-wave of rising prices will attain a higher level than its predecessor. Even now (observes Mr. Woodhouse), at this moment of greatest depression and stagnation, prices are at a level which a few years ago would have been regarded as high. As far as the Riga sawing trade is concerned, the forests which furnish the timber are now so far away from the rivers which carry the logs that Riga cannot be supplied unless prices are fairly high. If 70 per cent. of the cost price of a log in Riga consists of the expenses incurred in bringing it down from the forests, it is clear that a reduction can only be made on the remaining 30 per cent. By these remarks the British Consul does not, he assures his readers, intend to imply that the supply of timber is reaching its end. There is still plenty of timber, but it is becoming comparatively so inaccessible that in many parts it can only be worked out when prices rule high. Higher prices will always render accessible for supply those forests which were not considered worth while to work at low rates. It is much the same, in fact, as with coal and the working of deeper levels. Reviewing the operations of last year and the first half of this year, Mr. Woodhouse recalls that the spring of 1900 opened with abnormally high prices for sawn timber, both red and white. Unfortunately, however, for the Riga sawmills, they possessed in the aggregate only about 35 per cent. of their usual first open water stocks. As soon as the fresh rafts arrived the buying of logs was very keen, and astonishingly high prices were paid for the raw material, and early in the season every sawmill was hard at work cutting night and day in order to take advantage of the high prices ruling abroad for sawn goods. A rapid rise of freights, however, came as an unpleasant surprise to many who had sold goods ahead c.i.f., and a rate of 40s. was paid by sellers who had calculated on chartering at 25s. This great rise in freights checked the flow of business, Riga shippers being afraid to go on selling c.i.f., and the extra rate of freight, added to the already abnormally-high f.o.b. prices of sawn goods, made buyers hold back from purchasing. By September the consumption abroad also seemed to fall off, and, although freights had begun to get easier, it became more and more difficult to sell goods except at a reduction in prices all round. Riga sawmill owners, having by this time bought heavily of logs at high prices, were disinclined to accept lower figures. They imagined that the slackening of prices was only temporary, and that it would be better to hold over their goods until the spring; but in this they made a mistake. In January of the present year they might have sold a large proportion of their stocks at a reduction of only about 10s. per standard on the spring prices of 1900, but they all held stolidly back. Unfortunately, the sellers of other wood-producing countries followed the same policy. They all had large stocks, and thus by their waiting they brought about a rout along the whole line. Consumption, instead of improving, became slacker, and meanwhile buyers had discovered that stocks abroad were heavier than they had been led to suppose. As spring came on and the time for shipping drew near, the mill-owners of all countries began to feel restless, for, contrary to their experience of previous years, they had sold nothing; they therefore began to approach the buyers. These, however, soon understood the position. They were being offered goods from all sides, and they either held back or offered much lower prices. Those of the sellers who accepted proved to be the luckier ones, for as spring advanced each sale was at a progressively lower rate, while the buyers, who had bought first, thinking they were doing well in getting their goods so much cheaper, soon found themselves at a disadvantage with their competitors who had waited. The consequence of all this is that prices have tumbled all round, and yet there is no large buying, for, seeing prices continually dropping, buyers have grown nervous; there seems to be "no bottom," and now they are only buying from hand to mouth. The position in Riga is that there are unusually large unsold stocks for this time of the year,* and all who are able are still holding out, as they cannot bring themselves to face the loss which the selling-off at present low prices would entail. At least 90 per cent. of the mills are standing, most of which will probably remain idle until the autumn, as, by not adding to their stocks, they hope to dispose of what they have at better figures and stop the rout. The actual stock of sawn goods in Riga this last spring was barely an average one, and may be put down at 90,000 standards, against the usual 110,000 to 120,000 standards. In Sweden and other wood-growing countries, however, stocks were heavier. This year there will probably not be more than from 16,000 to 17,000 log rafts floated down to Riga, against 21,000 to 22,000 logs last year, a decrease of 25 per cent. or thereabouts.

The exports of wood of all kinds from Riga during the year 1900 amounted to 46,550,000 cubic feet, value 1,500,000*l.*, as against, in 1899, 46,700,000 cubic feet, value 1,748,870*l.*

Correspondence.

To the Editor of THE BUILDER.

THE DOUBLE CHOIR OF GLASGOW CATHEDRAL.

SIR,—The interest and importance of the subject may excuse a few notes on the valuable review of my book, "The Double Choir of Glasgow Cathedral," in your number of the 14th inst. It is, I think, something more than "a very unlikely conjecture" that the church of Jocelin at Glasgow, so far as it had been carried out, was pulled down by Walter. We know that this church was under construction between 1180 and 1190, and that accordingly a large part of the existing structure has been attributed hitherto to the twelfth century. Your reviewer accepts, however, my ascription of this work to Bishop Walter (1208-1232) as having "much likelihood." But if the work is of the thirteenth century, how are we to account for the disappearance of Jocelin's building, with the exception of a few fragments that have been built into the walls of Walter's chapel, and what other conclusion can we come to than that the unfinished work of Jocelin was pulled down by Walter? The fact also that Walter should have used some of the worked stones of Jocelin's church in adjoining the temporary altar and shrine of Kentigern, if so much is admitted, is further evidence that the earlier building had to give place to the later. There are not wanting instances of unfinished and even of completed works of the eleventh and twelfth centuries that were pulled down soon after their erection to make way for larger structures in the newer style then in course of development. Willis states that Lanfranc's choir at Canterbury was pulled down twenty years after its completion ("Canterbury Cathedral," p. 63). Viollet-le-Duc mentions that in France, at the beginning of the epoch of great cathedrals, the portions first constructed were sometimes pulled down to make way for still more magnificent projects ("Dictionnaire de l'Architecture," vol. ii., p. 284). Mr. E. S. Prior, at p. 70 of his recently published work, informs us that "the fabrics of most of the eleventh and twelfth century presbyteries have perished." The existing buildings, I think, demonstrate that in many cases the earlier work must have perished at the hands of the builders of the twelfth and thirteenth centuries. If it is the case that the unfinished choir of Jocelin was pulled down by Walter, it may be accepted, I think, as an incident in some measure characteristic of this particular period.

In quoting Viollet-le-Duc, to the effect that "all the great cathedrals of central France were begun, and to a large extent carried out, between the years 1180 and 1240," I have perhaps somewhat distorted his meaning. By way of amends I cite the passage referred to in his own words: "La période pendant laquelle les grandes cathédrales eussent dû êtres conçues et élevées, celle pendant laquelle leur existence est pour ainsi dire un besoin impérieux, l'expression d'un désir national irrésistible, est comprise entre les années 1180 et 1240" ("Dictionnaire de l'Architecture," vol. ii., p. 284). It is, of course, true that some of the extended cathedrals were founded before 1180, but the great wave of enthusiasm for cathedral building in central France is limited, according to Viollet-le-Duc, to sixty years.

The statement that the ridge-rib is never found in the earlier vaults may require some qualification, but the case of Ripon transept is in some measure covered by the reference on p. 43 to occasional instances "of partial anticipation of a still undeveloped trait." The ridge at Ripon is scarcely entitled to be called a rib; it is rather a slender ridge moulding, decorative in purpose and quite unlike the constructionally evolved ridge-rib of the thirteenth century. Such as it is, it is of great interest, but it does not touch an argument founded on the introduction of the ridge-rib into the vaulting system.

The suggestion that the tierceron was introduced to support the ridge-rib, as well as to help to carry the infilling, is not mine, but is given by Viollet-le-Duc ("Dictionnaire de l'Architecture," vol. iv., p. 117). In view of the number of dislocated ridge-ribs that we find, it is, I think, well founded.

The particular type of vault that I refer to as having been introduced about 1270 is the one with abbreviated ridge-ribs in both directions, while the nave vault at Lincoln has, I think, a continuous ridge in one direction. Probably I have not been sufficiently explicit on this point. It may be added that the dates in connexion with the development of vaulting are in some degree tentative. I know of no authoritative guide on the subject, and certainly make no claim to lay them down from my own knowledge or observation.

I agree with your reviewer that the carving of the capital of Jocelin's pillar (fig. 11) might be of the twelfth century, and have said so in the footnote on p. 33. I think, however, that it is more probably of the early part of the thirteenth century. So far as my observation goes, this type of carving is usually associated with mouldings of a later character and a capital of different form from the one in question. I shall hope for further assistance in determining the interesting point whether this capital, apparently of the twelfth century, owes its carving to the date of its re-erection in the early part of the thirteenth century or whether it was originally carved as we see it.

I have not stated that the materials of the clear-story were raised by a screw-jack. All that we know is that the larger stones were grappled by a "lewis," similar in principle to those in use to-day, and that they were then raised vertically by means of a mechanical appliance of some kind—probably of the windlass and pulley species. The screw-jack is figured as being the most powerful engine for raising loads that was known to the builders of the thirteenth century.

I have made no attempt to treat the cathedral exhaustively, or to correlate its architecture with any particular school of English Gothic. "Plan, bay design, piers, capitals, bases" are referred to incidentally, but my main purpose has been to show that in the vaulting we have a master-key which opens up to us much of the history and chronology of the building. It reveals the successive changes of plan of the middle vault; it affords some insight into the mind of the designer at each stage, and enables us to follow the steps by which the result as we now see it has been attained. I join in the hope that my work may be tested by the careful examination of others, and its deficiencies by this means amended.

T. L. WATSON.

BOOKS RECEIVED.

BRICKLAYING AND BRICKCUTTING. By H. W. Richards. (Longmans, Green, & Co.)

REPORT OF THE CHIEF LABOUR CORRESPONDENT ON STRIKES AND LOCK-OUTS OF 1900. (Eyre & Spottiswoode. 10½d.)

* Mr. Woodhouse's Report is undated, but it reached the Foreign Office in London on August 16, 1901.

The Student's Column.

GAS AND GAS FITTINGS.

13.—INCANDESCENT GAS BURNERS.

BURNERS WITH CHIMNEYS.—In this country all public gas supplies consist of illuminating gas, and in order to produce a non-luminous flame which will not deposit soot upon the mantles, the gas is consumed in "atmospheric" burners of the Bunsen type. The gas under pressure is made to issue in one or more fine jets in an upward direction into a vertical tube having holes formed in its sides near the base. The gas in its uprush draws air also into the tube through the side holes, and a mixture of air and gas flows to the head of the burner, and when ignited burns with a non-luminous flame. The efficiency of the flame so obtained depends upon the proportion of gas to air in the mixture, and the completeness of the mixing operation.

In the earlier forms of Welsbach burners the proportion of air drawn into the tube was not sufficient to produce a non-luminous flame of the required shape unless a chimney were used with the burner to create an updraught, and thus bring a strong current of air in contact with the surface of the mantle and flame. When the glass chimney supplied with burners of this description (fig. 29) is removed from the burner, the gas cannot obtain sufficient air for complete combustion until it has escaped through the network of the mantle, and a large proportion of the heat which should be utilised in bringing the mantle to an incandescent condition is lost.

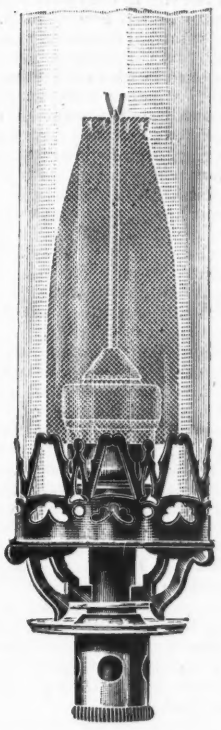


Fig. 29.—Welsbach "C" Burner, with Chimney.

The proportion of air required for combustion of the gas varies with the richness of the gas in illuminating hydrocarbons, and consequently the length of the glass chimney should be varied in accordance with the quality of the gas to be consumed. An 8-in. chimney is of sufficient length for use with London 16-candle gas, while for 14-candle gas a 6-in. chimney would be suitable, but with the 20-candle to 26-candle gas supplied in some parts of the North of England and Scotland a 10-in. or 12-in. chimney is required.

Effect of Dust or Dirt on the Burners.—In the course of a few weeks a considerable quantity of dust from the mantle, or from other sources, accumulates on the wire gauze of the burner, and on the gas nozzle near the air holes. The presence of this dust often reduces the light emitted by the mantle by fully 50 per cent. To remove the dust, lift the head of the burner off the Bunsen tube without removing the mantle from the head. Blow gently up the tube of the part removed in order to blow the dust off the gauze, and then unscrew the Bunsen tube from the nozzle from which the gas issues and remove the dust from the nozzle also. Then replace the parts in their original positions and relight the burner. Whenever a new mantle has to be placed on the burner, the latter should first be freed from dust.

Deposition of Soot upon Mantles.—The deposition of patches of soot upon incandescent mantles is caused by imperfect combustion of the gas. Imperfect combustion is usually due to the burner being in a dirty condition, and consequently producing a flame having more or less luminosity. Even a very feebly luminous flame will speedily produce a deposit of carbon upon the mantle. By-pass burners in which a small luminous flame is used to ignite the main flame without necessitating the use of a match are often rejected on account of their liability to blacken the mantles and to be extinguished by draughts. The small by-pass flame is often of sufficient size to come in contact with the mantle and to leave a black patch upon it. When burners without governors are used it is often impossible to avoid altogether this blackening, because the by-pass must pass sufficient gas to prevent the flame being extinguished when the pressure falls to its lowest point, and even when adjusted to the smallest dimensions under the lowest pressure the flame becomes sufficiently elongated when the pressure increases to its maximum point to come in contact with the mantle and blacken it. A useful by-pass device which gives two small non-luminous flames situated on the sides of the socket which receives the rod used to support the mantle, and which are not easily extinguished, has recently been invented by Mr. A. Clarke. It is a marked improvement upon burners having a luminous by-pass jet, but has not yet come into general use.

Chimneyless Incandescent Burners.—In 1898 the Welsbach Company placed upon the market a new burner for incandescent gas lighting which did not require a glass chimney. This burner is known as the "Welsbach-Kern" burner, and has attained great popularity. Bandsept had introduced a chimneyless burner a few years earlier, which was largely used for public lighting, but was not so serviceable for domestic lighting as are the small sizes of the Kern burner. The use of burners without chimneys is made possible by effecting a thorough mixing of the gas and air in the most efficient proportions before the mixture reaches the point of ignition. The light efficiency per unit of gas consumed obtained from the mantles when these Kern burners are used is found to be considerably greater than that obtained from the older forms of chimney burners; but owing to the hissing noise emitted by the chimneyless burners many consumers still prefer the less noisy chimney burners. It is stated that the production of a hissing noise is an indication that an excessive volume of gas is being consumed, and that the gas cock should be adjusted until the noise is no longer observable; but in practice this procedure is always found to produce an immediate diminution in the intensity of the light emitted. The average consumer will always adjust his burner to give the maximum amount of light, without regard to the gas consumption.

The effect of slightly increasing or decreasing the proportion of air to gas in the mixture issuing from the burner is shown in the following table published by Professor Lewes, who made a series of experiments with a chimneyless burner. The gas supply was maintained at a constant rate under a pressure of 1½ in., and the air supply was regulated as required. The gas used for the experiments was 16-candle London gas:—

Condition of Flame.	Rate of flow.		Ratio.		Candle-power per cubic ft. of gas.	Temperature of mantle 1 in. above burner-head.
	Gas. c. ft.	Air. c. ft.	Gas.	Air.		
Under aërated..	4·5	10·0	1	2·2	14·4	1880 C
Best aërated....	4·5	12·75	1	2·75	20·0	1915 C
Over aërated ..	4·5	15·25	1	3·4	17·7	1905 C

It was found by experiment that 1 volume of the gas required 5½ volumes of air for complete combustion, and it is therefore evident that the best results are obtained with 16-candle gas when half the total quantity of air required for combustion is mixed with the gas before the point of ignition to produce the inner zone of flame, while the second half enters into combination after ignition of the gas and produces the outer zone of flame in which the mantle is suspended.

High-pressure Burners.—By increasing the pressure of the gas supplied to the burner and increasing the consumption, it is found that a higher illuminating value per unit of gas consumed can be obtained than with low-pressure gas, and for street lighting with lamps of high candle-power high-pressure burners are being extensively adopted. Most of the high-power burners can be used without chimneys, but require a glass guard to protect the mantle from wind and the gaslighter's torch.

The Welsbach-Kern High-pressure Burner.—This burner closely resembles the Kern burner used with gas under ordinary pressures, and can readily be taken to pieces for cleaning (fig. 30). The burner is intended to be used with gas supplied under a pressure of 8 in. to 10 in., and is said to give a light of 30 to 35 candles per cubic foot of gas consumed per hour, as compared with a light of 20 to 25 candles per cubic foot obtained with the ordinary Kern burners. With a consumption of 10 cubic feet of gas per hour the high-pressure Kern burner is said to yield a light of 350 candle power.

At present gas is commonly supplied under a pressure of less than 3 in., and for high-pressure systems it is necessary to use compressing apparatus to raise the pressure to 10 in. or 12 in. When calculating the cost of a high-pressure system of lighting the cost of the compressing apparatus must be included.

There is, however, no reason why the gas companies should not be called upon to increase the pressure of the public supply to

Fig. 30.—Welsbach-Kern High-pressure Burner.

a. Burner complete. *b.* Burner with mantle removed.
c. The detachable parts of the burner; viz., outer cone, Bunsen tube, and inner cone.

10 in., since with the aid of inexpensive governors the consumer can readily reduce the pressure to any desired point; and it has been repeatedly demonstrated that by the use of suitable mains and fittings gas can be distributed under this comparatively high pressure without undue loss by leakage.

The Self-intensifying Kern Burner.—The Welsbach Company claim that results almost equal to those obtained with high-pressure gas can be obtained with gas under low pressure when consumed in the Self-intensifying Kern burner. This burner (fig. 31) is intended for use in the lighting of streets or industrial works. It is a Kern burner so modified that with the comparatively large gas consumption of 10 cubic feet per hour the head of the burner is sufficiently small to fit into a No. 4 high-pressure Kern mantle, a slight alteration being

Fig 31.—Self-intensifying Kern Burner, with "Shadowless" lantern.

made in the internal construction of the burner head. In the upper part of the lantern in which the burner is placed is a metal chimney from the lower end of which is suspended a glass chimney. The glass chimney surrounds the mantle, and the so-called "self-intensification" is due to the draught produced by the elongated chimney thus formed. It is claimed that a light of 300 candles is obtained with a consumption of about 10 cubic feet of gas per hour.

Compressing Apparatus.—To raise the pressure of the gas supplied to the burner to the 10 or 12 in. required for high-pressure gas lighting many devices have been adopted. In the Scott-Snell lamp the waste heat from the burner is employed to actuate a novel compressing apparatus which is located a short distance above the mantle; and in other systems, motors actuated by water supplied from the street mains are used. In the latter case the cost of the water must be taken into consideration when estimating the cost of the light, and it is usually found with all high-pressure systems that the mantles have a shorter life than when used with gas supplied under low pressure.

Anti-vibration Devices.—When incandescent gas lights were first used for street lighting it was found that the number of mantles broken by vibration and shock caused by the passage of heavy vehicles over the roads was so great as to almost prohibit their employment in the main thoroughfares. A number of anti-vibration devices were, however, soon invented and placed on the market, and some of these are now extensively used. They are mostly of simple construction and depend upon the interposition of some description of spring between the burner and the gas supply pipe to which it is attached. Those which depend upon the elasticity of india-rubber should be avoided, since this material perishes with comparative rapidity, and is affected by changes in the temperature of the atmosphere.

Advantage of Incandescent Lights over Luminous Flames.—The principal objections to the use of gas are:—(1) The heat generated is out of proportion to the light obtained; (2) The flames are usually more or less smoky, especially in draughty situations, and quickly blacken the walls and ceilings; and (3) The withdrawal of oxygen from the air and the formation of carbon dioxide by combustion of the gas is prejudicial to health. The luminous flames most commonly used are flat flames or argand flames, burning not less than 5 cubic feet per hour, and having an illuminating power of about fifteen candles. When these are substituted for incandescent burners, it is usual to introduce a burner giving a light of sixty candles for a gas consumption of 3·5 cubic feet per hour for every 15-candle flame previously in use. Consequently, a better light is obtained, the gas consumption is reduced 30 per cent., less heat is generated, and, owing to the use of a non-luminous flame as well as to the reduction in the temperature of the air and products of combustion rising from the burner, the ceilings are less rapidly blackened.

On the other hand, the mantles for which the high retail charge of 7½d. is at present made in this country require renewing periodically, and in some households are a constant source of trouble.

Until mantles less fragile than those at present manufactured are introduced the incandescent system cannot be regarded as altogether satisfactory, but great progress has been made since 1886, when Welsbach's earliest mantles were placed on the market, and there is every reason to believe that other improvements equally important may be made within the present decade.

Avoid Powerful Lights of Small Area.—The use of intense lights of small area should be avoided as much as possible in all systems of lighting. A 60-candle power light emitted from an area of 1 in. is more irritating to the eyes, and less serviceable for illuminating purposes, than a light of the same total intensity emitted from an area of, say, 6 in. Two No. 1 Welsbach-Kern burners fitted in suitable positions with good diffusive shades will effectively illuminate a dwelling-room of ordinary size (say, 22 × 15 × 10 ft.), although each burner consumes only 1·5 cubic feet of gas per hour, and has an illuminating power of probably only twenty-five candles; whereas a single burner having an illuminating power of seventy candles, and used without a shade, will be found to brilliantly illuminate one portion of the room while another part is left in comparative darkness. The fact that the two small burners have a total illuminating power of only 50 candles for a consumption of 3 cubic feet, while the larger burner gives a light of 70 candles with the same rate of gas consumption, does not necessarily prove that it is better to use the single burner instead of the two small burners. The electric arc light has a high illuminating power, but no one would select it for the illumination of dwelling-rooms, since it possesses in a marked degree the feature which it is most desirable to avoid—*i.e.*, it emits an intense light from a very small light-emitting surface.

GENERAL BUILDING NEWS.

PRIMITIVE METHODIST CHURCH, CHESTER-LE-STREET.—The foundation-stone of the new Primitive Methodist Church has just been laid at Chester-le-Street. The new church has been designed by Mr. J. W. Taylor, architect, of Newcastle, and will be built by Messrs. Davison & Bolam, contractors.

UNITED METHODIST FREE CHURCH AND SCHOOLS, FENTIMAN-ROAD, SOUTH LAMBETH, S.W.—The opening ceremony of these buildings took place recently. The buildings, which have been erected on a prominent corner site, are designed in Perpendicular Gothic, freely treated. The facings are of red bricks and the dressings of Bath stone. The roofs are covered with green slates. The church, school, and church-parlour gables all face Fentiman-road; the school, however, is set back to give prominence to the church. A square tower, containing angle entrance and staircase to the small end gallery, forms a prominent feature at the corner of the block; this is terminated by a small lead-dressed spirelet and vane. An octagonal narthex is a feature in front, and this contains the two main entrance-doors to the church. The church consists of nave, transepts, and apse, with side organ-chamber opening by arches into both apse and church. Accommodation for the choir is provided in the apse. A traceried and carved stone pulpit and dwarf screen on either side extending across the apse are the gift of a member of the church. A large platform, furnished with carved and traceried oak communion table and chairs, is placed in front of the pulpit and is surrounded by an oak handrail supported by carved oak newels and wrought-iron and copper standards. The seating is circular on plan. The apse arch is moulded Bath stone, supported by shafts with carved caps. The transept arches are carried on dwarf Irish green marble columns with stone caps and corbel bases. The accommodation of the church is for about 650 persons. A large schoolroom (which is arranged to be divided off into a number of classrooms), with gallery around, with wrought-iron grille in front, is provided, also church-parlour, vestry, ladies' working-room, library, infants' room, kitchen, with lavatories, &c. The whole block is lighted by electricity, the fittings being of wrought-iron and copper work. Low-pressure hot water has been adopted as a means of heating the buildings. The cost of the entire block is about 7,000*l.*, and has been carried out by Mr. J. O. Richardson, Peckham, S.E., from the designs and under the superintendence of Messrs. George Baines & R. P. Baines, architects, Clement's-inn, Strand, W.C.

CHURCH, PERTH.—A new church has been erected on the site of the old one by the congregation of St. Paul's United Free Church. In the front elevation the principal feature is the end gable of the church, with two four-light windows with cusped and panelled heads in the lower stage, and a large five-light window with traceried head and deeply-moulded joints lighting the gallery. The gable flanks are enriched with panelling, and the apex has an arcading of cusped panels with a central niche, over which a floriated cross forms the terminal feature. To the left of the main gable is a projecting stone porch, with wide moulded archway, forming the principal entrance, and to the right another doorway serves as exit from the gallery. The ladies' room and session-room form a two-story block to the left of the main entrance. The side elevations are simply treated with two tiers of triplet windows, the upper ones having trefoil cusped heads under an arch. Internally the church is divided into nave and side aisles by moulded columns and arches of wide span. The nave ceiling is semi-octagonal in form, divided into bays by arched timber ribs. Over the side aisles the main couples are also shown and filled with ornamental timber cusping. The church is planned with side and end galleries, but the side galleries are narrow and recessed at the columns. The total number of sittings provided will be 800, and the estimated cost is within 4 000*l.* The architect is Mr. John B. Wilson, Glasgow, and the works have been carried out under his instructions by the following contractors:—Mason, Mr. A. Beveridge; joiner, Mr. William M'Quibban; slater, Mr. D. M'Lauchlan; plumber, Mr. James M'Leish; plasterer, Mr. John Peebles; glazier, Mr. C. Alexander; electrical appliances, Mr. M'Leish; and Mr. Thomas L. Kay is clerk of works.

WESLEYAN CHURCH, TOTNES.—A new Methodist church and school were opened in Fore-street, Totnes, on the 19th inst. The building is of limestone, with Portland stone facings, and is entered over a flight of granite steps. In the south-east corner there is a tower with a short turret. New schoolrooms have also been built on the site, and were opened about a year since. The aisles are paved with wood blocks, and the seats are made of pitch-pine. The windows consist of stained glass. Messrs. Reeve, Son, & Full were the contractors, and Messrs. Bridgman, of Paignton and Torquay, were the architects. The cost of the building, including the purchase of the site, is about 3,000*l.*

UNITED METHODIST FREE CHURCH, WESTCLIFF-ON-SEA.—The foundation-stone of this building was laid on the 21st inst. The church is Late Perpendicular Gothic in style, freely treated, and is faced with red bricks externally, the dressings and tracery being of white Costessey work. The roof is covered with green slates. The main gable is flanked on the one side by a dwarf octagonal turret and on the other by a bold square tower, the latter terminating in a spirelet. The church is designed for future deep double transepts, but these are at present only to be erected to a depth of a few feet. A large school and classrooms are provided for in the future. The present portion is being erected by Messrs. Battley, Sons, & Holness, Old Kent-road, S.E., and the cost amounts to 2,124*l.* The architects, whose designs were accepted in a recent competition, are Messrs. George Baines & R. P. Baines, Clement's-inn, Strand, W.C.

BAPTIST CHURCH, LEWIN-ROAD, STREATHAM S.E.—The tender of 3,033*l.*, submitted by Messrs. W. Johnson & Co., Wandsworth, has been accepted for the erection of this building. A square tower and spire above form a feature of the design and front elevation. The building is faced with red bricks, and the dressings are of white Costessey work.

The roof is to be covered with green slates. The architects, whose designs were selected in a competition held some years ago, are Messrs. Geo. Baines & R. P. Baines, Clement's-inn, Strand, W.C.

CHURCH, NEWTON, OYSTERMOUTH. — The foundation-stone of the proposed new Church of St. Peter, at Newton, Oystermouth, was laid recently. The proposed church is eventually to seat 600 persons, and provision is now being made for 400 The total cost will be about 6,000*l*. Mr. Bruce-Vaughan is the architect, and Mr. Howells, Cardiff, the contractor.

PROPOSED ENLARGEMENT OF FISHPONDS CHURCH, BRISTOL.—It is proposed to enlarge the parish church of Fishponds. The enlargement, if carried out, will provide additional seats for 271 persons, at a cost of 1,700*l*. Plans have been prepared by Mr. E. H. Lingen Barker, architect.

BOARD SCHOOLS, GLOUCESTER. — The new Hatherley-road Board School, intended for the Lower Barton-street district, was opened on the 16th inst. The schools have been erected by Messrs. J. Gurney & Sons, of Gloucester, from designs and under the superintendence of Mr. Alfred J. Dunn, on a plot of land about 2¼ acres in extent, at a total cost, including playgrounds, playsheds, fence walls, caretaker's house, &c., of 11,548*l*. 10*s*., the accommodation being for 992 children.

INFANT SCHOOL, FRASERBURGH, ABERDEEN.—A new infant school, erected by the Fraserburgh School Board, to accommodate 600 scholars, was opened on the 18th inst. by Lord Saltoun. The school is designed by Mr. A. Marshall Mackenzie, A.R.S.A., Aberdeen, and is estimated to cost about 6,000*l*. when completed. The school is built on a site over two acres in extent in the west end of the town, at the corner of Victoria-street and Windmill-street. It is a one-story school, the buildings being about 140 ft. in length and 70 ft. deep. The design provides ten classrooms, a hall, teachers' rooms, and cloakrooms for the children. The central part of the building is the hall, 85 ft. long by 21 ft. wide, while to the rear are built out, close together, six of the classrooms, each under a separate roof. Four of these rooms, each 21 ft. by 23 ft., extend the same length as the hall. The other two at either end are larger rooms, 21 ft. by 25 ft., and the structure of them is brought forward by wing blocks which provide other four classrooms, one at either end, in line with the hall, 21 ft. by 25 ft. and 21 ft. by 21 ft., and the other two in front, 20 ft. by 25 ft. and 16 ft. 6 in. by 26 ft. The space between these two latter, which project several feet outwards, and which form the front of the school, is utilised for the cloakrooms and teachers' retiring-rooms. The school is built of a light grey-coloured stone from the Peathill Quarry, near New Pitsligo, the front and east side being of dressed masonry, and the back and west side of ashlar work. The flooring and wall linings are of pitch-pine, the inside doors and all finishings of American yellow pine, and the structural work of Swedish redwood. The classrooms afford accommodation for from fifty to sixty scholars each, who will be on raised galleries. Each of the classrooms is provided with a fireplace and ventilated on the Boyle system of ventilation. There is extensive playground accommodation, at the north end of which is a stretch of shelter sheds, with latrine conveniences built of enamelled brick. The contractors for the work are :—Mason, Mr. William Davidson, New Pitsligo; carpenter, Messrs. Brebner & Jenkins, Fraserburgh; plumber, Mr. Archibald Russell, Fraserburgh; slater, Mr. James Reid, Fraserburgh; plasterer, Mr. Alexander Wiseman, Fraserburgh; and painter, Messrs. Mitchell & Mitchell, Aberdeen.

FREE LIBRARY, GRANGETOWN, CARDIFF.—A few months since the first of the sectional lending libraries of Cardiff was opened in new buildings in Splotland. The second one was declared open at Grangetown a few days ago, and the third is fast approaching completion at Roath. The new library at Grangetown is situated on the junction of Clive-street and Redlaver-street. The architect was Mr. E. M. Bruce-Vaughan, whose design was selected in an open competition. The building is of red brick with stone facings. The contractors were Messrs. D. Thomas & Son, and Mr. Tom Taylor was clerk of the works.

COTTAGE HOSPITAL, EBBW VALE.—A cottage hospital for accident cases has been erected at Ebbw Vale, at a cost of over 3,000*l*. The architects were Messrs. Lansdowne & Greggs, Newport, Messrs. S. T. Davies & Sons, Ebbw Vale, being the contractors. The building is situated near Hillside House. The ground floor contains the matron's suite of rooms, entrance hall, receiving room, and operating theatre. The floor is mosaic, and the walls of adamant cement. The second floor contains a main ward with five beds and a cot, No. 2 Ward with four beds for more serious cases, and a special ward with one bed. There is also a day room for convalescents, opening out by means of French windows to a large verandah. The second floor also contains a bathroom, kitchen, lavatories, &c.

ASYLUM, KINGSEAT, ABERDEEN.—The foundation-stone has just been laid of the hospital at Kingseat, forming part of the asylum buildings for the Aberdeen City District Lunacy Board. The extent of ground set apart for the asylum buildings, including cricket and recreation grounds, is about 40 acres The plans were entrusted to Mr. A. Marshall Mackenzie, A.R.S.A., architect, Aberdeen. The ground is laid out in three sections. In the first place, what may be termed the general section consists of the administration building, kitchen, and stores, laundry, steward's house, hall, medical superintendent's house, conservatory, gardener's and engineer's lodges, &c. Then the second section is that devoted to industrial work. It consists of what are termed colony villas, two for male patients, accommodating respectively forty-two and thirty-two persons each; and two villas for female patients on an exactly similar plan and with similar accommodation. The female colony is placed on the east of the administration block, and the male to the west of these buildings, while at a convenient point between the two villas for male patients are the workshops, where those who are physically fit will be employed in occupations suited to their skill and capacity. On the other hand, the villas for the female patients have been erected not far from the laundry, where, as well as in the kitchen, a number of the patients who are capable will be employed in useful occupations. The villas are comfortable buildings of two stories. On the ground floor of the villas for females there are a kitchen, dining-room, dayrooms, bathroom, with stores, &c. The first floor is entirely devoted to dormitories, with two or three rooms for special uses. The same arrangement applies to the villas for male patients, which are each under the charge of a married caretaker, who has two rooms allotted to his use. Coming to the medical section, the principal building is the hospital, which is of two floors, but a second story is planned to be erected over the part of the hospital devoted to administration purposes. On the ground floor, on one side, are three large dormitories and a dayroom for female patients, and exactly similar accommodation on the opposite side of the block for male patients, and there are single rooms off the dormitories attached to all the wards, which will be used for special cases. An isolation ward will also form part of the plan, with accommodation for about four male and four female patients in each. The centre building of the block consists of medical superintendent's rooms, waiting-rooms, and admission-rooms. On the upper floor is accommodation for nurses and doctors during the day, consisting of parlour or sitting-room, bathrooms, &c. The dormitories are ventilated on the Plenum system. On either side of the hospital there are observation villas, one for male and the other for female patients, who are provided to the number of thirty-seven in each building. On the lower floor of each are dayrooms, dining-rooms, kitchen, and other accommodation, and in the floor above are dormitories and single rooms. In addition to all the accommodation described there are four closed villas, two for male and two for female patients, who require, from the nature of their cases, special treatment and supervision. For the females the villas accommodate respectively thirty-five and twenty-seven patients each, and the villas for males are substantially the same. The recreation hall, which occupies a prominent position on a circular piece of ground near the centre of the asylum area, is intended to give accommodation for 400 persons. For the nurses of the institution special provision is made in what may be termed the nurses' home, fitted up with comfortable bedrooms. Among the buildings on which substantial progress has been made is the power house, laundry, and kitchen administration block. For the hospital the whole of the excavations are finished. The work will now be pushed rapidly on under the superintendence of Mr. Alex. Souter. Roughly speaking, the cost of the property, including the water rights and the whole of the buildings, amounts to over 70,000*l*. The contractors and the amount of the contracts are :—Mason work, Mr. Edgar Gauld, 26,983*l*.; carpenters, Messrs. Hendry & Keith, 16,526*l*.; slaters, Messrs. Adams & Co., 2,521*l*.; water, Messrs. Blaikie & Sons, 3,784*l*.; ironwork, Messrs. Grant & Co., 1,151*l*.; plumber, Mr. A. B. Robertson, 6,748*l*. The plaster-work has not yet been contracted for.—*Aberdeen Journal.*

HOSPITAL EXTENSION, SALFORD.—The Mayor of Salford opened on the 18th inst. two new pavilions which have been erected at a cost of 20,000*l*. as an extension of Ladywell Sanatorium. Built from the designs of Mr. Henry Lord, the two pavilions are provided with eighty beds. The chambers, apart from the wards, include a "sun room" and a retiring hall.

ARTISANS' DWELLINGS, BRIDE'S ALLEY AREA, DUBLIN. — The work of constructing suitable residences for the artisan classes in this long-neglected quarter of old Dublin is proceeding with fairly satisfactory rapidity under the personal supervision of the City Architect, Mr. C. J. MacCarthy. At present the first section of dwellings, comprising nine separate blocks, and containing in all seventy-two tenements, is rapidly approaching completion. The contract for this section of the work is upwards of 17,000*l*. The second section of the building operations is also well advanced, the walls being 15 ft. over the ground. This section comprises eleven blocks, containing sixty-six separate tenements or flats, several of these being intended for the use of the better class of artisans. Some of them will be three-roomed, and will, it is expected, readily let at 5*s*. to 6*s*. per week, while others will be two-roomed, with a probable rent of 3*s*. 6*d*. to 4*s*. 6*d*. per week; but all, whether two- or three-roomed, will be self-contained. The cost of this section will be about 15,000*l*., or 32,000*l*. for both. Mr. James Donovan, of Harcourt-street, is the contractor for both sections. When all is completed and the 138 tenements fully occupied, accommodation will be available for some 700 persons, allowing five to each family, and the Bride's-alley area will have undergone a wonderful change from its former dreadful condition. The third and concluding section in the same area has not yet been begun, but will be commenced in due time.—*Irish Times.*

TECHNICAL DEPARTMENT, MECHANICS' INSTITUTE, PUDSEY.—The new technical department of the Pudsey Mechanics' Institute has just been opened. Mr. Herbert Hodgson, of Pudsey, is the architect. The eight classrooms, two on each floor, which form the principal block of the new building, have a turreted gable facing Waver Green, where there is a separate entrance. All the windows in the staircases and landings are stained. The classrooms themselves are inter-communicating on each floor. All the heating is done by low-pressure hot water. The two large classrooms in the basement will be used as workshops, and the old tearoom on this floor has been enlarged so as to be available for use as two classrooms. Altogether, this and the extension generally will provide accommodation for 600 students over and above those for whom room is found in the older premises. Lavatories and cloakrooms are provided on each floor.

COTTAGE HOMES, CULCHETH, LANCASHIRE.—On the 19th inst. the chairman of the Salford Board of Guardians laid the foundation stone of cottage homes which the Board is proceeding to build at Culcheth for children. Various sites in Lancashire and Cheshire were visited within a radius of twelve miles. Twiss Green estate Culcheth was eventually decided upon, and 45 acres of land were purchased for 4,500*l*. The Board appointed Mr. H. Lord as their architect, and his plans were finally adopted. The provision made comprises eleven semi-detached homes, accommodating twelve children each, with rooms for the foster mother. There are also two single homes accommodating twelve each, and making the total accommodation 288. There will be an infants' school and a mixed school to accommodate 399 boys, girls, and infants, while the hospital will accommodate sixteen children and the requisite staff. The administrative block includes workshops, bakery, laundry, bandroom, and swimming baths, and an electric light installation. A superintendent's house is provided. The estimated cost of the work, including building and furnishing, is 63,711*l*. There will be playgrounds, and the elder boys will be taught various trades and the girls instructed in sewing and housework.

WORKMEN'S DWELLINGS, BRISTOL.—From the annual Report of the City Engineer's department of the Bristol Corporation we learn that workmen's dwellings are being erected, in accordance with the requirements of the Local Government Board, for the purpose of rehousing those persons whose dwellings have been pulled down under various schemes of street improvement. Four sites have been selected, all in densely-populated districts, and sixty dwellings are in course of erection. The dwellings are divided into two classes : a first-class house contains a living-room, 14 ft. by 13 ft. 10 in. by 8 ft. 6 in.; two bedrooms, average size respectively, 14 ft. by 8 ft. by 8 ft. 6 in., and 9 ft. 3 in. by 9 ft. by 8 ft. 6 in.; wash-house, 8 ft. by 4 ft. 6 in. by 8 ft. 6 in. Maximum number of persons, five. The second-class houses contain living-rooms, 14 ft. by 13 ft. by 8 ft. 6 in.; bedrooms, 12 ft. by 9 ft. 6 in. by 8 ft. 6 in.; wash-house, 8 ft. by 4 ft. 6 in. by 8 ft. 6 in. Maximum number of persons, three. The following are the sites upon which the various dwellings are being erected—viz., Chapel-street, St. Philip's, fourteen first-class, ten second-class; Bragg's-lane, St. Jude's, six first-class, four second-class; Mill-pond-street, Baptist Mills, sixteen first-class, four second-class; Mina-road, two first-class, four second-class. The buildings are of red brick, and the roofs are covered with double Roman tiles. The tenements are built in pairs, one situated on the ground floor, and the other on the first floor. Those on the ground floor are approached direct from the street, but those on the first floor from an iron verandah, 3 ft. wide, which runs the whole length of the building, and is reached from the street by a wide, open fireproof staircase. The living-rooms are well lighted, and provided with an open kitchen grate with oven. Each bedroom has a fireplace fitted with a mantel register grate. In the wash-house are a boiler and small coal cupboard. The floors are of cement concrete, floated up to a smooth face. The dwellings on the ground floor have a back as well as a front entrance, but those above can only be approached from the verandah before referred to. At the back of each block of tenements is a spacious yard laid with tar paving, and is available for the use of all persons occupying the dwellings. Galvanised-iron ash-bins are provided for general use. The drainage of the buildings has received special attention, and each pair of tenements has an intercepting chamber between it and the main drain. The drains are ventilated throughout.

COLLEGE, SCARBOROUGH.—The new college at Scarborough, which has been erected on the Weaponness Estate, South Cliff, has just been

opened. The buildings include a schoolroom 54 ft. by 24 ft., six classrooms, reading-room, dining-hall to seat 120 boys, covered playground, and cycle-house, dark-room for photographers, four large dormitories, ten small bedrooms, sick-rooms, lecture-hall for science teaching, preparation room, and large chemical and physical laboratories. The total cost of the building, apart from the furnishing, has been about 12,000*l.* The architects are Messrs. Hall, Cooper, & Davis, of Scarborough and London, and the contractors are as follows:—Mr. W. Overton, brick, stone, and plaster work; Mr. G. Scales, carpentry and joiner work; Messrs. Appleby & Brogden, ironwork; Mr. G. F. Wells, plumbing work; Mr. Joseph Hargreaves, tiles; Mr. Thomas Fidler, painting; Mr. H. C. Fehr, London, sculptor work; Messrs. Emley & Sons, Newcastle, heating and ventilating; Messrs. C. White & Co,. London, school furnishing; Mr. T. B. Jowsey, entrance gates; Mr. W. Malton, roadways; whilst the grounds are being laid out by Mr. L. Thompson, of Scarborough. The building was described and illustrated in our issue for August 10.

TECHNICAL SCHOOL, NEW BRIGHTON, CHESHIRE.—On the 21st inst. the new technical school, New Brighton, was formally opened. The school has been erected at a cost of 5,400*l.* upon a site at the corner of Field-road and Rawson-street, Upper Brighton, and has been designed by the District Engineer and Surveyor (Mr. W. H. Travers), and erected by Mr. John Gourley, contractor, of Liscard and Liverpool. It is built of Ruabon brick with Storeton stone dressings. An external feature is an octagonal tower containing a teachers' room on each floor. The building is two stories in height, the main entrance being in Field-road. The ground floor comprises vestibule, inner hall, classroom, to be used temporarily as a reading-room, cooking and laundry classroom, with pantry and stores, workshop, cloakroom, and lavatory; while the second floor includes two classrooms and a science lecture-room. The heating and ventilation have been carried out by Messrs. Dargue, Griffiths, & Co., Liverpool. The electric light installation is the work of Messrs. Brewer & Brunt, Hoylake. The floors generally are of fireproof construction, finished chiefly with wood-block paving.

ESSEX CHURCH, THE MALL, KENSINGTON.—This church, which some fourteen years ago took the place of the old Essex-street Chapel, Essex-street, Strand, under a scheme approved of by the Charity Commissioners, has during the summer vacation had extensive works executed to it, and to the large assembly hall and schoolroom underneath the church. The timber roof of the church has been cleaned and varnished, and the whole of the internal brick and stone work throughout the interior thoroughly brushed down and cleaned, including the Bath stone and alabaster reredos. The old gas-fittings have been removed, and the church has been lighted by electricity. In the assembly hall and schoolroom underneath the church the electric light has also been installed, and a new heating apparatus has been fitted to heat this part of the building independently of the church. The cost of the various works has amounted to upwards of 450*l.* The work has been carried out under the direction of Mr. H. Chatfeild Clark, the architect of the church, the building works being executed by Messrs. Campbell, Smith, & Co., the new heating apparatus by Messrs. Edwards & Son, and the electric light installation by Mr. Herbert Nash.

LADY BAY MISSION CHURCH.—The new portion of this church has just been dedicated. The Lady Bay Mission was established about three years ago, as an adjunct to the parish church of West Bridgford. A temporary iron church, with seating accommodation for 170 persons, was erected, but its capacity was soon considerably outgrown, and the erection of a more commodious building was decided upon. The first portion of this has been completed, and will be used in conjunction with the western portion of the iron structure for the present. The extension consists of a nave and small chancel, 56 ft. in length and 28 ft. wide, giving, with the old building, a total length of about 80 ft., and affording accommodation for 550 persons. The building is of red brick, with stone facings. The nave has an open roof, with semi-circular pitch-pine principals, and the chancel arch is of red sand brick. The extension has cost between 400*l.* and 500*l.*, and is from the plans of Mr. W. R. Gleave, of Nottingham, the builders being Messrs. W. H. & J. Simons. As funds permit and requirements dictate, it is intended to carry the building westwards to a frontage upon Pierrepoint-road. The final part of the scheme will include the erection of a church of more pretentious architectural appearance upon a site in the vicinity, and the building now partially completed will be eventually used as a church hall and Sunday school.

SANITARY AND ENGINEERING NEWS.

BRIDGE, MONQUHITTER, ABERDEEN.—On the 14th inst. the new bridge just completed over the Turriff Burn at Mill of Pott was opened for traffic. The new bridge is of one span. Mr. Ferguson, Fyvie, carried out the mason work; the ironwork was entrusted to Messrs. Abernethy & Co., Aberdeen; while Messrs. James Duncan & Son, architects, Turriff, were inspectors of works.

PADSTOW DRAINAGE.—On the 19th inst. a Local Government Board inquiry was held at Padstow by Colonel A. G. Durnford into the scheme to provide a water supply to the town. It is proposed to adopt a source at a distance of about four and a half miles, where springs will be collected and conducted to a receiving chamber, and thence to a service reservoir at an ample elevation above the town. The Inspector visited the source with the Engineer, Mr. Gordon W. Harris, and carefully investigated the means to be adopted to avoid pollution.

STAINED GLASS AND DECORATION.

ST. STEPHEN'S CHURCH, AVENUE-ROAD.—This church has been in process of decoration. The chancel is treated in colour and gold; on the upper part of the east wall are angels with censers in adoration of the Agnus Dei; on each side of the window under canopies with a mosaic background are the figures of St. Stephen and St. Andrew. The reredos (yet to be finished) will be rich in gold ornament, and the Four Evangelists painted in gold with gesso backgrounds. The side walls are diapered, supported by arcading, with emblems of the Passion in gold, and a dado in reds, green, vellum, and gold. The nave walls are diapered, with borders to the wall plate and window headings; the spandrels are filled with ornament in salmon, red, and green, with various devices in white on red grounds Round the base of the nave walls is the text, "Now have I chosen and sanctified this House that My Name may be there for ever, and Mine eyes, and Mine heart shall be there perpetually." The work has been designed and carried out by Messrs. H. G. Bartlett & Co., of Brixton.

FOREIGN.

FRANCE.—There is some talk of the Municipal Council of Paris acquiring the Hôtel de Sens, with the view of making an annexe to the Historical Museum of the city.——The Mairie of the XIXth arrondissement of Paris is to be enlarged.——The jury in the competition opened by the Municipality of Lous-le-Saunier for the rebuilding of the theatre in that town, recently destroyed by fire, has awarded the first premium to MM. Georges and Tony Ferret, architects, of Bourg, and the second to M. Jules Pelletier, of Lous-le-Saunier. The third premium was not awarded.——The fine bronze group by M. Frémiet, of St. George and the Dragon, is shortly to be placed in the centre of the large gallery of the Petit Palais of the Champs Elysées.——The death is announced, at St. Etienne, of M. Barthélemy Chaperon, an architect in the department of Monuments Historiques.

INDIA.—A large bridge of three spans of 12-ft. girders is under construction at mile 40·22 on the eastern section of the Eastern Bengal State railway, to protect the permanent way from floods.——It is proposed to substitute new steel girders for the existing weak 10 ft. to 25 ft. spans on the South Indian Railway.——The Kopili Bridge on the Assam-Bengal railway is now completed. It consists of three 100-ft. span girders and eighteen 60-ft. span girders.——A considerable addition is being made to the Bengal-Nagpur railway by the construction of a branch line from Ramkanali, chiefly for the conveyance of minerals.——We learn that the total outlay of the Public Works Department in restoring buildings in Assam damaged or destroyed by the great earthquake of 1897 amounts to Rs. 41,12,000 up to the end of 1899-1900. This does not include the cost of extensive repairs to roads and bridges in certain districts.——The proposed railway line in Kashmir, to run from Jammu to Srinagar, will traverse the Larulari and Banihal passes. The top of the latter pass is 9,328 ft. above sea level, and will be pierced by a tunnel about 5,670 ft. in length.——The combined military secretariat and foreign offices in Calcutta, designed by Mr. Banks Gwyther, are to be erected on the Belatee bungalow site, taking in some adjacent grounds. The design shows a central main carriage entrance, which is treated as a Classical portico feature surmounted by a pediment.——Additions are about to be made to the Medical College and Eden Hospitals in Calcutta, to accommodate the nursing staff.——A new building has been commenced at the Presidency General Hospital, Calcutta, to accommodate certain kinds of infectious cases.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENTS.—Messrs. Lansdell & Harrison, architects, have removed their offices from 38, Bow-lane to 65 and 66, Basinghall-street, E.C.——Messrs. Doulton & Co. have opened new showrooms at 30A, Paradise-street, Birmingham, for the display of sanitary fittings, fireplaces, wall panels, &c.

ELECTRIC LIGHTING, WORKSOP.—About two years ago the Urban District Council of Worksop obtained the provisional order for providing electric light, and in October of last year commenced to build a generating station at their depôt on Canal-road. This has been completed under the direction of Mr. A. B. Mountain, M.I.E.E., of Huddersfield, the consulting engineer, and the plant was a few days ago opened. The buildings consist of a boiler-house, to accommodate four Lancashire boilers, of which two have been fixed at present, raising steam up to 600 h.-p.; engine-room for two 100-kilowatt plants, and three 150 ditto, with the necessary condensing plants, pumps, boosting plants, and switch-boards. The plant at present fixed is sufficient to generate electricity for 11,600 lamps of 8 c.-p., and there are also accumulators provided.

DISCOVERIES AT RABY CASTLE.—Lord Barnard is now restoring and renovating the chapel at Raby Castle, and during the work of clearing the walls of a layer of plaster some interesting discoveries were made. The chapel is the oldest portion of the castle, dating from the middle of the fourteenth century; and at the west end was disclosed a six-light window of that period, about 14 ft. wide and 8 ft. high, walled up with solid masonry about 2 ft. thick. This was completely removed, with the almost perfect sills. Head, jambs, mullions, and tracery are now to be seen. This was evidently originally an open screen, or unglazed window, opening from the end of the chapel into the "Baron's Hall," the side of which abuts on it, and was, no doubt, for the purpose of enabling persons in the hall, or general living-room, to participate in the services which, prior to the Reformation, took place at the altar opposite. On the south side was found a fourteenth-century doorway and a beautiful three-light window of later — probably, fifteenth century—work. This, too, seems to have been an unglazed window or screen between the chapel and a small chamber or pew. Another discovery is the ancient fourteenth-century aumbry, which has been found nearly perfect in the east wall, to the south of the altar.—*Standard.*

PROPOSED ABATTOIRS, ST. IVES.—The Corporation of St. Ives having applied to the Local Government Board for sanction to borrow 1,000*l.* for the provision of public slaughter-houses near the road between Nanjivey and the Stennack, an inquiry was held in the Town Hall on the 19th inst. by Colonel A. G. Durnford, R E. The Borough Surveyor (Mr. J. Grenfell) produced plans of the proposed buildings, and in reply to the Town Clerk stated that the nearest dwelling-house to the site proposed was 33 yards distant, and that was the property of the Corporation, who were prepared to pull it down if there was any objection to it. The walls of the proposed buildings would be 2 ft thick, and the floors of cement concrete.

NEW THOROUGHFARE TO TOWER BRIDGE.—A portion of the new roadway, from the Tower Bridge to Artillery-street, skirting the churchyard of St. John the Evangelist, Southwark, has been open for eighteen months, and now a new section has been opened—that between Grange-road and the Bermondsey New-road. From Artillery-street the road passes under the ornamental arch of the South-Eastern and Chatham Railway Company's widened line, and is perfectly straight from the Tower Bridge to the Church of St. Mary Magdalene, Bermondsey, where, in order to avoid passing through the churchyard, it sweeps in a grand crescent into the Bermondsey New-road. A third section is nearly completed. The pavement throughout, on both sides (some 12 ft. wide), will be bordered by trees—a few already have een planted.

STONEHENGE.—The great leaning monolith at Stonehenge has been raised into a perpendicular position. The stone was encased in a cradle of strong timber to prevent it from cracking, and strong ropes were carried to two powerful winches, by means of which the raising was effected. The monolith was shored up on every side with timber, and every precaution was taken to guard against an accident of any kind. Now the stone is raised it presents quite an imposing appearance. It stands 21 ft. above the ground, its total length being about 29 ft. 6 in., and its estimated weight more than 30 tons. The excavations necessary for putting in a bed of concrete on the north-west side of the stone will now be proceeded with in the most careful manner, and it is believed that some important discoveries will be made near the famous altar stone.—*Standard.*

RUSSIAN THEATRE SAFETY COMMISSION IN LONDON.—Count Suzor, the President of the Russian Theatre Safety Commission, is now on a visit to London inquiring into the effect of our regulations in regard to the protection of theatres from fire He has made an inspection of the British Fire Prevention Committee's new testing station, with a view of creating similar facilities for research at St. Petersburg, under a scheme mooted in connexion with the terrible fire losses which have occurred in Russia during recent years.

NATIONAL PHYSICAL LABORATORY, BUSHEY.—We are asked to mention that the floors in this building, briefly described in our last issue, are being laid with patent pitchpine woodblock flooring from the Cement, Concrete, Asphalte and Wood Pavement Works, Farnworth.

LEGAL.

EMPLOYERS' LIABILITY ACT.

LABOURER'S FALL DOWN A HOLE.—QUESTION AS TO CONTRIBUTORY NEGLIGENCE.

AT Marylebone County Court on Monday, before Judge Stonor and a jury, William Thomas Smith, a

bricklayer's labourer, 19, Charles-street, Queen's-road, Notting-hill, brought an action under the Employers' Liability Act, against Messrs. Babcock & Wilcox, Limited, contractors, &c., 30, Farringdon-street, E.C., claiming damages in respect of personal injuries sustained, owing—it was said—to negligence for which the defendants were responsible.

Mr. John O'Connor, counsel, appeared for the plaintiff, and Mr. Addington Willis, counsel, for the defendants.

Plaintiff's counsel explained that on January 28 last his client was in the employment of the defendants, working at the Notting Hill Electric Lighting Company's depot at Wood-lane, Shepherd's Bush. In order to get some castings and fittings fixed as soon as possible the plaintiff, with a few other men employed by the defendants, was working overtime. At about a quarter to twelve at night the defendants' foreman fitter, Logan, told the plaintiff to go to the tool-house, about 100 yards away, and fetch a spanner.

In answer to the judge, the learned counsel explained that the defendants were doing the work in question under a contract with the Electric Lighting Company.

Continuing, Mr. O'Connor said it appeared that between the boiler-house, where the men were working, and the tool-house, there was a hole some 15 ft. deep, in which a coal elevator was to be erected. No lights were about, and as the plaintiff was on his way to the tool-house he fell down the hole, seriously injuring both wrists and hurting his back and face.

The plaintiff bore out his counsel's opening statement, and in cross-examination admitted that when he found it pitch dark outside the boiler-house he did not go back and ask for a lamp, although he knew that there were two on the job. He had several times prior to the accident seen the hole down which he fell.

Other evidence having been given,

John Logan, an engineer's fitter in the employ ot the defendants, said that he had charge of the job in question. He admitted giving the order to the plaintiff to go to the tool-house and fetch a spanner, but said he was not aware that the spot near the hole was in complete darkness. He had spoken to one of the Electric Lighting Company's officials about having the electric lights turned on all night, and understood the official to consent.

The Judge: You can't say exactly what answer he gave?—Witness: No, I only took it by his muttering that he agreed with what I said. There was no definite answer that I can recall.

Continuing, the witness stated that at six, and also at seven o'clock, on the night in question, the electric lights were on. Afterwards he was working in a furnace and could not see that they had been turned off.

The judge put questions as follow to the jury:—1. Do you believe that the witness Logan had the conversation with the Electric Lighting Company's engineer, and understood that the electric lights would be kept in during the time the men were working? 2. Do you think that the witness Logan was justified in thinking that the lights were still in when he gave the order to the plaintiff to fetch the tool? 3. Do you think that the plaintiff was guilty of contributory negligence in knowingly and willingly running the risk in question?

The jury answered the questions in the plaintiff's favour, assessing the damages at 70*l.* 5s.

His Honour gave judgment accordingly, with costs.

Counsel for the defendants asked for liberty to bring a new trial on the ground that the jury's answer in the negative to the third question was against the weight of evidence.

His Honour intimated that application for a new trial would have to be made in the usual way.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

9,535.—A COMBINED LEVEL AND STRAIGHT-EDGE: *A. Thom.*—A removable double spirit-level for plumbing and levelling purposes is mounted upon a graduated straight-edge, and for inclined work is provided a pivotted strip to be clamped with wing-nuts and a graduated slot at any small angle required. For fastening the spirit-level may be used either a stud and keyhole arrangement or a tapering dovetailed groove to correspond with a feather upon the straight-edge.

9,574.—BEAMS AND GIRDERS: *G. Stockfisch.*—For carrying the ends of the joists extended flanges are fashioned upon angle, channel, T or I-section beams and girders, and transverse webs are added for strengthening purposes.

9,601.—FIREPROOF CONSTRUCTION: *W. Seefels and O. Soldan.*—Metal lathing or light open metal-work, fixed between standards, girders, &c., and overlaid with cement, plaster, or concrete, constitute the material for building hollow fireproof floors, ceilings, walls, and so on; in the case of an arch a skeleton frame is made up with curved and straight laths or strips, and for a hollow wall or partition the skeleton frame is made of U-shaped strips and cross strips, together with cross-shaped or double T-shaped standards, with bolts, rivets, and clips; for stairs, some strips, set lengthwise, are joined with triangular strips, and in the concrete at the front of each step is embedded a channel iron bar to be filled in with lead or other suitable material; at either side is a channel-iron girder and an angle-iron girder for carrying the framework.

9,620.—FITTINGS FOR LAVATORIES: *B. G. Smith.*—The inventor seeks to avoid the necessity for soldering by making the trap and overflow-pipe constitute one piece of casting, a socket is provided for the fixing of the overflow outlet, and the basin outlet is screwed on to the trap.

9,626.—FASTENINGS FOR WINDOWS: *F. H. Edwards.*—To one sash is secured a casing to which is pivotted a tumbler recessed for engagement with a lug upon a plate affixed to the other sash. On the tumbler are projections which engage respectively with a weight that slides in the casing and a projection from the plate. For opening the window one lifts the weight on to a rest in the casing where it is freed by the tumbler. For closing the window the weight is lifted by means of the engagement of two projections, and when the tumbler has thus assumed the "locking" position it cannot be worked since the weight has fallen behind it. A modified adaptation provides for lifting the weight and turning it into a horizontal position about the projections which serve for pivots, when one wishes to open the window.

9,633.—STOVE-PIPE FITTINGS: *G. Pickhardt.*—The pipe of a portable stove is inserted into an annular space that consists of a hollow metal cylinder fixed to the wall and a conical tube at the inner end of the cylinder, the free end of the stove-pipe being secured in its place with springs or other means.

9,643.—APPARATUS FOR USE WITH LIFTS: *F. Fletcher.*—By this apparatus bolts are shot beneath the bottom of the cage when the well-door is opened; a shaft having pinions at its ends that engage with sliding rack bolts carries a wheel set so as to engage with a worm upon a shaft above, a pinion upon the upper shaft is in gear with a rack upon the bottom edge of the sliding door; the bolts therefore are shot into the well and supply a support for the cage with the opening of the door; the inventor contrives also that bevel gearing shall impart the movement of the door to the rack bolts.

9,654.—CONDUITS FOR ELECTRICAL CONDUCTORS: *F. Hamblet and I. Parkes.*—Clay forced into a mould fashions a triangular socket, and clay pressed through a die fashions the body of the conduit. A die or core that fits the interior of the socket is fitted on to a table that will rise and fall, and cores or plugs for making the passages are bolted on to the bridge-pieces, as the table and socket fall the mould, which falls with them, touches the heads of some supporting bolts. The die has rounded recesses for making the rounded ends of the partitions, and as the socket is being moulded air can escape through holes in the die. The contrivance is described as being applicable for making conduits with two, four, or more passages.

9,671.—APPARATUS FOR USE IN DEEP-BORING: *A. Raky.*—The inventor contrives that the rocking-lever may be shifted so as to obviate the need for removal of the frame when percussive tools are to be replaced with diamond drills. He makes guides (on the frames) of a pair of open rails or of a frame whereof one side is hinged, or of a single rail with which forked pieces upon the lever will engage. Projections from the lever can be engaged with or liberated from the guides by the action of rack and screw-and-worm gearing.

9,725.—BRICKLAYING AND WALL BUILDING: *E. H. Vordtriede.*—Recesses in the bricks above take ribs on the bricks next below, and there are grooves at the corners of the bricks for vertical keys; a wall may be built of bricks having double interlocking ribs and grooves secured with double dovetailed keys, and portable temporary structures may be built without the use of cement or mortar; in the case of hollow walls there are recesses in the inner vertical edges of the bricks that will fit with spacing keys which join interlocking bricks together.

9,727.—A COMBINED REGISTER AND HOOK FOR USE WITH CRANES: *C. H. P. Michael.*—A spring-controlled disc is pivotted between the two side plates of the hook, and over it is a register or counter from which hangs a rocking lever having a forked end for engagement with a pin on the side of the disc; as a load ascends the sling will engage with a recess in the disc, so that it becomes closed and locked through the engagement between a spring bolt and a stop, and when the bolt has been freed with a key the disc is turned again into the open position, and so enables the counter or register to do its work.

9,730.—APPLIANCE FOR ELECTRICAL SWITCHES: *F. S. Worsley and F. J. Green.*—For a double-pole switch there are arms that project from an insulating boss turning upon a fixed spindle and that carry U-shaped contact pieces. Two pins which turn the boss engage with teeth of a sleeve turning upon a boss which is attached to the spindle. In a slot in the boss will slide a locking cross-bar which is in the sleeve, being pressed up by a spring into a groove in the cover of the sleeve. The bar is to be pressed downwards with a key inserted into the cover, so that one can turn the cover and the switch contacts together.

9,746.—AN ELECTRICITY METER: *A. Wright and Reason Manufacturing Company.*—In a mercury voltameter the electrodes of mercury are disposed outside two porous diaphragms, the electrolyte being between them, and thus form two containers for the mercury; for purposes of registering may be utilised the overflow of the mercury cathode from a porous pot into a measuring-tube, the anode being kept at a rather higher level with mercury admitted from a feeding-bulb; for the two containers can be substituted parchment or similar bags attached to vertical measuring-tubes wherein the cathode mercury will rise and the anode mercury will fall. Confer also Nos. 2,222, 5,046, and 5,593 of 1900.

9,762.—A COMPOSITION FOR USE IN BRAZING: *H. Garner.*—A protective composition for use in bending, brazing, and kindred operations consists of borax and boracic acid mixed with water or any other suitable liquid—the admixture is to be applied as a coating which can be wiped off afterwards, and it is claimed to be available as a flux in brazing.

9,779.—A WINDOW-SASH FASTENER.—*N. W. Spaulding.*—A curved spur that projects from a plate on one sash is to be engaged with a slotted arm which is pivotted to a plate upon the other sash, when the arm is lifted for separating the sashes a lug upon the slotted arm will engage with the spur-plate, the movement of the arm is restricted with a stop and it will fall down so as to engage with the spur through impact of the spur-plate and the lug as one shuts the window.

9,808.—CONSTRUCTION OF PARTS OF BUILDINGS: *L. de Vallière.*—For girders, beams, bressummers, ceilings, floors, and so on the inventor devises a material composed of concrete in which are embedded rounded tension rods made of iron, together with flattened helical coils of wire of which the sides have an inclination of 45 deg., more or less, to the rods.

9,813.—APPARATUS FOR VENTILATION: *J. W. Thomas.*—A valve that opens vertically is so disposed within a turret provided with louvres, and above the roof-crest that when it is shut its upper flange fits around the seating, for lifting and lowering purposes is provided a cord having at its end a stirrup that will engage with an automatically fixing-hook which is held in its place (when the stirrup is hooked) through the engagement of the rear end of the hook with a rack; a scale—adjusted in accordance with the temperature of the outer air—serves for determining the extent of the necessary opening of the valve, and a flap or windmill appliance is placed over an opening outwards in order to indicate any variation between the relative air-pressures, inside and outside, which the ventilator should be adjusted to remedy.

9,967.—STONE-DRESSING MACHINERY: *T. Stiglis.*—The threaded portion of the spindle that works through a ratchet wheel retained in one direction with a pawl turns the tool round at its return stroke, whilst a crank-and-slot movement, driven with bevel-gearing from a flexible shaft, imparts the reciprocatory motion; a saddle, which traverses the cross-head, carries the tool-holder, and screws will vertically adjust the cross-head upon the frame, which is moved upon the rails by means of screws—by another arrangement the stone itself is moved.

MEETINGS.

SATURDAY, SEPTEMBER 28.

Sanitary Institute (*Demonstrations for Sanitary Officers*).—Inspection at the Richmond Main Sewerage Pumping Station and Purification Works, Kew Gardens, 3 p.m.

TUESDAY, OCTOBER 1.

Sanitary Institute (*Lectures for Sanitary Officers*).—Dr. H. R. Kenwood on "Water: Composition, Pollution, and Purification." 7 p.m.

WEDNESDAY, OCTOBER 2.

Builders' Foremen and Clerks of Works' Institution—Ordinary meeting of the members. 8 p.m.

Sanitary Institute (*Lectures and Demonstrations for Sanitary Officers*).—(1) Inspection at Lambeth Disinfecting Station, Wanless-road, Loughborough Junction. 3 p.m. (2) Dr. H. R. Kenwood on "Elementary Statistics." 7 p.m.

THURSDAY, FRIDAY, and SATURDAY, OCTOBER 3, 4, and 5

Royal Institute of British Architects. — Visit to Glasgow and Annual Dinner. The programme as at present arranged is as follows:—Thursday, October 3 Annual Dinner. Friday, October 4: (1) Lunch in the Exhibition grounds, given by the Glasgow Institute to the Royal Institute visitors. (2) Visit to the Glasgow University (tea). (3) Conversazione given in honour of the Royal Institute by the Corporation of Glasgow. Saturday, October 5: Visits to Exhibition, &c.

FRIDAY, OCTOBER 4.

Sanitary Institute (*Lectures for Sanitary Officers*).—Mr. J. Wright Clarke on "Details of Plumbers' Work, 7 p.m.

SATURDAY, OCTOBER 5.

British Institute of Certified Carpenters.—Monthly meeting. Mr. W. T. Sweett on "Modern Joinery." 6 p.m.

Sanitary Institute (*Demonstrations for Sanitary Officers*).—Inspection at the Sewage and Destructor Works, Ealing. 2.15 p.m.

Northern Architectural Association.—Visit to Newcastle Breweries' premises, Haymarket, and Electric Power Station, Newcastle.

CONTRACTS AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., Supplied by	Tenders to be delivered
*Broken Granite	Brentford U.D.C.	Nowell Parr, Clifden House, Boston-road, Brentford	Oct. 1
Sewers, &c.	Bradford-on-Avon U.D.C.	S. Howard, Surveyor, Town Hall, Bradford-on-Avon	do.
Sewerage Works, Bridge and Granville-streets	Dover Town Council	H. E. Stilgoe, Civil Engineer, Town Hall, Dover	do.
House, Cambourne, Cornwall	Mr. J. F. Pearce	J. F. Pearce, Cambourne	do.
Electric Lighting Works	Poplar Borough Council	L. Potts, Council Offices, High-street, Poplar, E.	do.
Wheels and Axles, Switches, &c.	India Office	Director General, India Office, Whitehall, S.W.	do.
Granite (2,500 tons)	Aldershot U.D.C.	N. F. Dennis, Civil Engineer, Aldershot	do.
Laundry, Stanway, Essex	Lexden & Winstree Guardians	G. H. Page, Architect, Trinity Chambers, Colchester	do.
Wood and Granite Paving Blocks and Setts	Great Yarmouth Town Council	J. W. Cockrill, Civil Engineer, Town Hall, Great Yarmouth	do.
Chapel, &c., Caister	do.	do.	do.
Schools, Salisbury-road	Plymouth School Board	H. J. Snell, Architect, 11, The Crescent, Plymouth	do.
Workshops, &c.	Windsor Royal Gaslight Company	J. H. Strange, 2, Victoria-street, Windsor	do.
*Pavilion on New Pier	New Britannia Pier Co., Yarmouth	Mayho & Haley, Amberley House, Norfolk-street, Strand, W.C.	do.
Electricity Buildings	Swindon Corporation	Lacey & Co., Engineers. 2, Queen Anne's-gate, Westminster	Oct. 2
Pumping Machinery, &c., Warning Camp, Sussex	Littlehampton U.D.C.	H. Howard, Engineer, Town Offices, Littlehampton	do.
Drainage Works at Workhouse, Barham, Suffolk	Bosmere & Claydon Guardians	H. Miller, 16, Museum-street, Ipswich	do.
Sinking Well, Hadley-road	Enfield U.D.C.	R. Collins, Surveyor, Court House, Enfield	do.
Electric Cables	Rochdale Corporation	C. C. Atkinson, Borough Engineer, Town Hall, Rochdale	do.
Boundary Walls, &c., Uphill Manor	Weston-super-Mare School Board	H. F. Price, Architect, School Board Offices, Weston-super-Mare	do.
Paving Works, Locking-road	do.	do.	do.
Additions to Workhouse, Barnhill	Glasgow Parish Council	MacWhannel & Rogerson, Archts., 59, West Regent-st., Glasgow	do.
Fire Station and Cottage, Newton-road	Rushden (Northants) U.D.C.	W. B. Madin, Civil Engineer, Vestry Hall, Rushden	do.
*Construction of Sewer	Wimbledon U.D.C.	Engineer, Council Offices, Broadway, Wimbledon	Oct. 3
Steel Girders, Albion-street	Salford Corporation	N. W. Woodward, Engineer, Town Hall, Salford	do.
Road Improvement Works, Bank-street	Castleford U.D.C.	Mr. Green, Surveyor, Castleford	do.
Laying Main (2¼ miles) Meerbrook Slough	Ilkeston Town Council	G. & F. W. Hodson, Engineer, Town Hall, Ilkeston	do.
Cement, Sewer Pipes, &c.	Bray (Ireland) U.D.C.	P. MacDonnell, Town Hall, Bray	do.
Steel Girder Bridge, Blackmill, near Bridgend	Ogmore U.D.C.	H. D. Williams, Civil Engineer, Blackmill, nr. Bridgend, S. Wales	do.
*Coastguard Buildings, Bexhill	Admiralty	Coastguard Station, Bexhill	Oct. 4
Walls, &c., at Cemetery	Carrickfergus U.D.C.	W. D. R. Taggart, Civil Engineer, 17A, Donegall-street, Belfast	Oct. 5
Additions to Police Station, Thornaby	Yorkshire County Council	County Surveyor, Northallerton	&c.
Sewers, &c.	Bideford Corporation	C. E. Bruges, Civil Engineer, 1, Victoria-st., Westminster, S.W.	do.
*Stables, Cart Shed, Stores, &c.	Camberwell Council	Borough Engineer, Town Hall, Camberwell	Oct. 7
Water Supply Works, Killea	Londonderry Town Council	J. J. S. Barnhill, Civil Engineer, 1A, Strand, Londonderry	do.
Granite Road Metal, Cradley Heath, Staffs	Quarry Bank U.D.C.	A. Homfray, Council Offices, Cradley Heath, Staffs	do.
Mortuary Buildings, Chapel, &c., Stockport-road	Cheadle U.D.C.	G. H. Brady, Architect, 18, Little Underbank, Stockport	do.
*Lighting of School	Ilford School Board	C. J. Dawson, 7, Bank-buildings, Ilford	do.
*Roadmaking and Paving Works	Willesden District Council	O. Claude Robson, Dyne-road, Kilburn, N.W.	Oct. 8
*Granite Setts	Edmonton U.D.C.	G. Eedes Eachus, Town Hall, Lower Edmonton	do.
Superstructure of Electric Lighting Station, Greenhill	Oldham Corporation	A. Andrew, Corporation Offices, Oldham	do.
Additions to Workhouse, Selly Oak	King's Norton Guardians	Mansell & Mansell, Surveyors, Colmore Row, Birmingham	do.
*New Generating Station at Greenhill	Oldham Corp. Electricity Dept.	A. Andrew, Gas and Water Offices, Oldham	do.
Lodge, &c., Longbridge-road	Barking (Essex) U.D.C.	C. F. Dawson, Surveyor, Public Offices, Barking	Oct. 9
*Heating St. James' Church, Wood Green	The Committee	McKenzie, 58H, Hatton-garden, E.C.	Oct. 10
*Erection of School	Farningham School Board	G. H. Tait, Architect, Dartford, Kent	Oct. 12
Town Hall	Cheltenham Corporation	Waller & Son, Architects, 17, College-green, Gloucester	do.
*New Visiting Rooms	Wilts County Asylum	County Surveyor, County Offices, Trowbridge	do.
*Additions, &c., to Workhouse	Berkhampstead Union	C. H. Rew, Architect, Berkhampstead	do.
*Firemen's Cottages, &c.	Beckenham U.D.C.	J. A. Angell, Surveyor, Beckenham	Oct. 14
*Broken Granite	Hanwell U.D.C.	Council Offices, Hanwell, W.	do.
Cattle Market, &c.	Braintree (Essex) U.D.C.	F. Whitmore, Architect, Chelmsford	Oct. 15
*School Buildings, near Croydon	St. Olave's Union	A. H. Newman, Architect, 31, Tooley-street, S.E.	Oct. 17
*Heating and Ventilating, Youghal Lunatic Asylum	Cork District Lunatic Asylum	H. A. Cutler, Municipal Buildings, Cork	Oct. 21
*Town Hall	Cheltenham Corporation	Town Clerk, Municipal Offices, Cheltenham	Oct. 30
House, Shop, &c., Micklegate, Pontefract	.....	Garside & Pennington, Architects, Ropergate, Pontefract	No date
Business Premises, Market Place, Pontefract	Mr. Blackburn	Tennant & Bagley, Architects, Pontefract	do.
Wesleyan Chapel & School, Worsborough Dale, Yorks	.....	G. Moxon, Architect, 26, Church-street, Barnsley	do.
Cast-iron Pipes	Cowes (Isle of Wight) U.D.C.	W. Halliday, 40, High-street, Cowes, Isle of Wight	do.
*Heating of School	Ilford School Board	C. J. Dawson, 7, Bank-buildings, Ilford	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Application to be in
*Assistant Clerk of Works	County Borough of Salford	3*l.* per week	Sept. 30
*Clerk of Works	Derby Corporation	Not stated	Oct. 1
Engineer and Surveyor	Stoke-upon-Trent Town Council	250*l.* per annum	do.
Surveyor, &c.	Tavistock U.D.C.	Not stated	do.
*Clerk of Works	Walsall Corporation	4*l.* 4*s.* per week	Oct. 5
*General Manager	Camberwell Council	200*l.* per annum	Oct. 7
*Storekeeper	do.	150*l.* per annum	do.

Those marked with an asterisk (*) are advertised in this Number. *Competitions, p.* —. *Contracts, pp.* iv. vi. viii. x. & xxiv. *Public Appointments, pp.* xxi. & xxiv.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 13.—By G. B. HILLIARD & SON (at Chelmsford).

Sandon, Essex.—Southlands Farm, 157 a. 2 r. 5 p., f. — £1,010
Great Baddow, Essex.—Bell-st., two freehold cottages — £40

September 14.—By Messrs. SPELMAN (at Norwich).

East Tuddenham, &c., Norfolk.—An occupation farm, 56 a. 1 r. 19 p., f. and c. — £1,000
Freethorpe, Norfolk.—The Lockgate Farm, 74 a. 3 r. 30 p., f. — £1,050
Tofts Monks, &c., Norfolk.—Four grazing marshes, 43 a. 1 r. 27 p., f. — £50

September 16.—By Messrs. KEMSLEY.

Poplar.—449 to 461 (odd), East India Dock-rd., u.t. 72 yrs., g.r. 46*l.* 4*s.*
Bromley-by-Bow.—14 and 16, Abbott-rd., u.t. 72 yrs., g.r. 12*l.*, r. 70*l.*
Canning Town.—127, 129, and 133, Barking rd., u.t. 79½ yrs., g.r. 30*l.*, r. 150*l.*
— £3,900

By KING & CHASEMORE.

Slinfold, Sussex.—Part of the Pinkhurst Estate, 89 a. 3 r. 29 p., f. — £1,150

By CASTIGLIONE & GIBBINGS (at Carlisle).

Hayton, Cumberland.—Part of Ash Tree Farm, 41½ a., f. — £1,820

By SEXTON & TAYLOR (at Clare).

Porlingford, Suffolk.—Clopton Hall Farm, 155 a. 2 r. 17 p., f. — £910

September 17.—By C. H. BROWN.

Chelsea.—2, Upcerne-rd., u.t. 66½ yrs., g.r. 6*l.* 16*s.*, e.r. 45*l.* — £350

By COCKETT & HENDERSON.

Wanstead.—Hermon Hill, Elmwood, f., e.r. 70*l.* — £1,200

By WILLIAM WESTON.

Willesden Green.—23 and 29, Rutland Park, u.t. 92 yrs., g.r. 17*l.* 10*s.* — £1,000

By C. P. WHITELEY and GUDGEON & SONS (at Winchester).

Twyford, Hants.—Twyford Lodge and 21 a. 1 r. 14 p., f. — £9,000
The Cottage and 3 r. 27 p., f. — £1,000
Water Farm, 8 a., f. — £1,175
Water Farm House and 1 a. 1 r. 19 p., f. — £1,100

Three freehold meadows, 20 a. (including fishing rights) — £1,625
Beaulieu Cottages and two cottages adjoining, f., r. 48*l.* — £10
Watley Farm, 137 a. 3 r. 34 p., f. — £2,575

By BOYTON, PEGRAM, & BUCKMASTER (at Walham Green).

Fulham.—5 and 7, Goodson-rd., f. — £30
26, Knivet-rd., u.t. 71 yrs., g.r. 5*l.* — £70

By STRAKER & SON (at Abergavenny).

Bryngwyn, &c., Monmouth.—The Bryngwyn estates, 405 a., f. — £9,250

September 18.—By F. PERKS.

Tolleshunt D'Arcy, &c., Essex.—The Guisnes Court Estate, 1,851 a. 0 r. 19 p., f. — £22,600

By BISLEY & SONS.

Bermondsey.—59 to 63, Vienna-rd., u.t. 22 yrs., g.r. 12*l.* 15*s.* 6*d.* — £760

By WM. WESTON (at Paddington).

Bayswater.—25, Burlington-rd., u.t. 58 yrs., g.r. 10*l.* 10*s.* — £500
Maida Hill.—28, Bravington-rd., u.t. 77 yrs., g.r. 7*l.* — £400

September 19.—By BRIANT & SONS.

Kennington.—56, Royal-rd., u.t. 48 yrs., g.r. 5*l.* 15s., e.r. 34*l.*	£350

By W. F. LAING.

Hackney.—28 and 30, Groombridge-rd., u.t. 52¼ yrs., g.r. 12*l.*, r. 86*l.*	740

By ALEX. PHILLIPS & CO.

Shepherd's Bush.—52, Godolphin-rd., u.t. 76 yrs., g.r. 7*l.*	280
67, Stowe-rd., u.t. 76 yrs., g.r. 7*l.* 7s.	265
Brondesbury.—11, Callcott-rd., u.t. 82 yrs., g.r. 8*l.* 8s., e.r. 55*l.*	555
Marylebone.—42, Boston-pl., u.t. 19 yrs., g.r. 4*l.* 4s.	165
8, Hereford-st., u.t. 18½ yrs., g.r. 16*l.*	130
18 and 24, Horace-st., f.	560

By SIM & RANDALL.

St. George's East.—22, Cable-st., f., r. 52*l.*	1,000
Forest Gate.—44, Earlham-grove, f., e.r. 50*l.*	700

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.			
Hard Stocks	1 14 0	per 1,000	alongside,	in river
Rough Stocks and Grizzles	1 11 0	,,	,,	,,
Facing Stocks	2 12 0	,,	,,	,,
Shippers	2 8 0	,,	,,	,,
Flettons	1 8 6	,,	at railway	depôt.
Red Wire Cuts	1 14 6	,,	,,	,,
Best Fareham Red	3 11 0	,,	,,	,,
Best Red pressed Ruabon Facing.	5 5 0	,,	,,	,,
Best Blue Pressed Staffordshire	4 4 6	,,	,,	,,
Do., Bullnose	4 9 0	,,	,,	,,
Best Stourbridge Fire Bricks	4 2 6	,,	,,	,,
GLAZED BRICKS				
Best White and Ivory Glazed Stretchers	13 0 0	,,	,,	,,
Headers	12 0 0	,,	,,	,,
Quoins, Bullnose, and Flats	17 0 0	,,	,,	,,
Double Stretchers	19 0 0	,,	,,	,,
Double Headers	16 0 0	,,	,,	,,
One Side and two Ends	19 0 0	,,	,,	,,
Two Sides and one End	20 0 0	,,	,,	,,
Splays, Chamfered, Squints	20 0 0	,,	,,	,,
Best Dipped Salt Glazed Stretchers and Headers	12 0 0	,,	,,	,,
Quoins, Bullnose, and Flats	14 0 0	,,	,,	,,
Double Stretchers	15 0 0	,,	,,	,,
Double Headers	14 0 0	,,	,,	,,
One Side and two Ends	15 0 0	,,	,,	,,
Two Sides and one End	15 0 0	,,	,,	,,
Splays, Chamfered, Squints	14 0 0	,,	,,	,,
Seconds Quality White and Dipped Salt Glazed	2 0 0	,,	less than best.	

	s. d.	
Thames and Pit Sand	7 3	per yard, delivered.
Thames Ballast	6 0	,, ,,
Best Portland Cement	34 6	per ton, delivered.
Best Ground Blue Lias Lime	25 6	,, ,,

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime	12s 6d. per yard, delivered.
Stourbridge Fire-clay in sacks, 28s. od.	per ton at rly. dpt.

STONE.

	s. d.	
Ancaster in blocks	2 0	per ft. cube, deld. rly. depôt.
Bath ,,	1 7	,, ,,
Farleigh Down Bath	1 8	,, ,,
Beer in blocks	1 6½	,, ,,
Grinshill ,,	1 10	,, ,,
Brown Portland in blocks	2 2	,, ,,
Darley Dale in blocks	2 1½	,, ,,
Red Corsehill ,,	2 5	,, ,,
Red Mansfield ,,	2 4½	,, ,,
Hard York in blocks	2 10	,, ,,
Hard York 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	2 8	per ft. super at rly. depôt
,, ,, 6 in. Rubbed Ditto	3 0	,, ,,
,, ,, 3 in. sawn both sides slabs (random sizes)	1 3	,, ,,
,, ,, 2 in. self-faced Ditto	0 9½	,, ,,
Hopton Wood (Hard Bed) in blocks	2	3 per ft. cube. deld. rly. depôt
,, ,, 6-in sawn both sides landings	2	7 per ft. super. deld. rly. depôt.
,, ,, 3-in. do.	1	2½ ,, ,,

SLATES.

In. In.	£ s. d.	
20×10 best blue Bangor	11 5 0	per 1000 of 1200 at ry. dep.
,, best seconds ,,	10 15 0	,, ,,
16×8 best ,,	6 2 6	,, ,,
20×10 best blue Portmadoc	10 18 0	,, ,,
16×8 best blue Portmadoc	6 0 0	,, ,,
20×10 best Eureka unfading green	11 2 6	,, ,,
16×8 ,, ,,	6 15 0	,, ,,
20×10 Permanent green	10 0 0	,, ,,
16×8 ,, ,,	5 12 6	,, ,,

PRICES CURRENT (*Continued*).

TILES.

	s. d.			
Best plain red roofing tiles	41 6	per 1,000	at rly.	depôt
Hip and valley tiles	3 7	per doz.	,,	,,
Best Broseley tiles	48 6	per 1,000	,,	,,
Hip and valley tiles	4 0	per doz.	,,	,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000	,,	,,
Do. ornamental Do.	60 0	,,	,,	,,
Hip tiles	4 0	per doz.	,,	,,
Valley tiles	3 9	,,	,,	,,
Best Red or Mottled Staffordshire Do. (Peakes)	50 9	per 1,000	,,	,,
Hip tiles	4 1	per doz.	,,	,,
Valley tiles	3 8	,,	,,	,,

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.	
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	14 10 0	16 10 0	
Deals: best 3 by 9	13 10 0	14 10 0	
Battens: best 2½ in. by 7 in. and 8 in. and 3 in. by 7 in. and 8 in.	11 0 0	12 0 0	
Battens: best 2½ by 6 and 3 by 6	0 10 0	less than 7 in. and 8 in.	
Deals seconds	1 0 0	less than best	
Battens: seconds	0 10 0	,, ,, ,,	
2 in. by 4 in. and 2 in. by 6 in.	9 0 0	10 10 0	
2 in. by 4½ in. and 2 in. by 5 in.	9 0 0	10 0 0	
Foreign Sawn Boards— 1 in. by 1½ in. by 1½ in.	0 10 0	more than battens.	
¾ in.	1 0 0	,,	
Fir timber: Best middling Danzig or Memel (average specification)	At per load of 50 ft. 4 10 0	5 0 0	
Seconds	4 5 0	4 10 0	
Small timber (8 in. to 10 in.)	3 12 6	3 15 0	
Swedish balks	2 15 0	3 0 0	
Pitch pine timber (35 ft. average)	3 0 0	3 10 0	

JOINERS' WOOD.

	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.	25 0 0	26 0 0
3 in. by 9 in.	22 0 0	23 0 0
Battens, 2½ in. and 3 in. by 7 in.	18 0 0	20 0 0
Second yellow deals, 3 in. by 11 in.	20 0 0	21 0 0
,, ,, 3 in. by 9 in.	18 0 0	19 0 0
Battens, 2½ in. and 3 in. by 7 in.	14 0 0	15 0 0
Third yellow deals, 3 in. by 11 in. and 9 in.	14 10 0	15 10 0
Battens, 2½ in. and 3 in. by 7 in.	12 0 0	12 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	22 0 0	23 0 0
Do. 3 in. by 9 in.	19 0 0	20 0 0
Battens	14 0 0	15 0 0
Second yellow deals, 3 in. by 11 in.	15 10 0	16 10 0
Do. 3 in. by 9 in.	14 0 0	15 0 0
Battens	11 10 0	12 0 0
Third yellow deals, 3 in. by 11 in.	13 10 0	14 10 0
Do. 3 in. by 9 in.	13 0 0	13 10 0
Battens	10 10 0	11 10 0
White Sea and Petersburg:— First white deals, 3 in. by 11 in.	15 0 0	16 0 0
,, ,, ,, 3 in. by 9 in.	14 0 0	15 0 0
Battens	12 0 0	13 0 0
Second white deals 3 in. by 11 in.	14 0 0	15 0 0
,, ,, ,, 3 in. by 9 in.	13 0 0	14 0 0
,, ,, battens	10 10 0	11 10 0
Pitch pine: deals	16 0 0	18 0 0
Under 2 in. thick extra	0 10 0	1 0 0
Yellow Pine— First, regular sizes	30 0 0	33 0 0
Broads (12 in. and up)	2 0 0	more.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—Planks, per ft. cube	0 3 6	0 4 6
Danzig and Stettin Oak Logs— Large, per ft. cube	0 2 6	0 3 0
Small ,, ,,	0 2 3	0 2 6
Wainscot Oak Logs, per ft. cube	0 5 0	0 5 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 8	0 0 7
in. do. do.	0 0 7	- - -
Dry Mahogany— Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch	0 0 10	0 1 0
Teak, per load	16 0 0	20 0 0
American Whitewood Planks— Per ft. cube	0 3 0	0 3 6
Prepared Flooring—	Per square	
1 in. by 7 in. yellow, planed and shot	0 13 6	0 16 6
1 in. by 7 in. yellow, planed and matched	0 13 6	0 17 6
1¼ in. by 7 in. yellow, planed and matched	0 16 0	1 1 0
6 in. at 6d. per square less than 7 in.		
1 in. by 7 in. white, planed and shot	0 11 0	0 13 0
1 in. by 7 in. white, planed and matched	0 11 6	0 13 6
1¼ in. by 7 in. white, planed and matched	0 14 0	0 16 6
6 in. at 6d. per square less than 7 in.		

JOISTS, GIRDERS, &c.

	In London, or delivered to Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	6 15 0	7 15 0
Compound Girders ,, ,,	8 15 0	10 0 0
Angles, Tees and Channels, ordinary sections	8 12 6	10 12 6
Flitch Plates	8 15 0	9 10 0
Cast Iron Columns and Stanchions, including ordinary patterns	7 5 0	9 0 0

PRICES CURRENT (*Continued*).

METALS.

	Per ton, in London. £ s. d.	£ s. d.
IRON.— Common Bars	8 0 0	8 10 0
Staffordshire Crown Bars, good merchant quality	8 10 0	9 0 0
Staffordshire "Marked Bars"	10 10 0	- - -
Mild Steel Bars	9 0 0	9 10 0
Hoop Iron, basis price	9 5 0	9 15 0
,, ,, galvanised	16 0 0	- - -
(* And upwards, according to size and gauge.)		
Sheet Iron, Black.— Ordinary sizes to 20 g.	10 0 0	- - -
,, ,, to 24 g.	11 0 0	- - -
,, ,, to 26 g.	12 10 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality.— Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	12 10 0	- - -
,, ,, 22 g. and 24 g.	13 0 0	- - -
,, ,, 26 g.	14 0 0	- - -
Sheet Iron, galvanised, flat, best quality.— Ordinary sizes to 20 g.	16 10 0	- - -
,, ,, 22 g. and 24 g.	17 0 0	- - -
,, ,, 26 g.	18 10 0	- - -
Galvanised Corrugated Sheets.— Ordinary sizes, 6 ft. to 8 ft. 20 g.	12 10 0	- - -
,, ,, 22 g. and 24 g.	13 0 0	- - -
,, ,, 26 g.	14 0 0	- - -
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	12 5 0	- - -
,, ,, 22 g. and 24 g.	13 5 0	- - -
,, ,, 26 g.	14 5 0	- - -
Cut nails, 3 in. to 6 in. (Under 3 in. usual trade extras.)	9 10 0	10 0 0

LEAD, &c.

	Per ton, in London. £ s. d.	£ s. d.
LEAD—Sheet, English, 3 lbs. & up.	14 17 6	- - -
Pipe in coils	15 7 6	- - -
Soil Pipe	17 17 6	- - -
ZINC—Sheet— Vieille Montagne ton	24 10 0	- - -
Silesian	24 0 0	- - -
COPPER— Strong Sheet per lb.	0 1 0½	- - -
Thin ,,	0 1 2	- - -
Copper nails ,,	0 1 2	- - -
BRASS— Strong Sheet ,,	0 0 11	- - -
Thin ,,	0 1 1	- - -
TIN—English Ingots ,,	0 1 4½	- - -
SOLDER—Plumbers' ,,	0 0 7	- - -
Tinmen's ,,	0 0 8	- - -
Blowpipe ,,	0 0 9	- - -

PLASTER, &c.

	s. d.	
Coarse Plaster	30 6	per ton delivered.
Fine ,,	47 6	,, ,,
Superfine ,,	88 6	,, ,,
Coarse Keenes and Parian cement	55 0	,, ,,
Fine do. do.	75 0	,, ,,
Robinson's Fireproof Cement	50 0	,, ,,
Do. Fine white, finishing (Exclusive of the ordinary charge for sacks.	55 0	,, ,,
Whiting	27 0 to	30 0 ,, ,,
Cow hair for plastering	£9 0 0	,, ,,

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	3d.	per ft. delivered.
,, ,, fourths	2¾d.	,, ,,
21 oz. thirds	3¾d.	,, ,,
,, ,, fourths	3¾d.	,, ,,
26 oz. thirds	5d.	,, ,,
,, ,, fourths	4¼d.	,, ,,
32 oz. thirds	6d.	,, ,,
,, ,, fourths	5¼d.	,, ,,
Fluted sheet, 15 oz.	3¼d.	,, ,,
,, ,, 21 ,,	4¼d.	,, ,,
½ Hartley's Rolled Plate	3d.	,, ,,
⅝ ,, ,, ,,	3½d.	,, ,,
¼ ,, ,, ,,	4d.	,, ,,

OILS, &c.

	£ s. d.	
Raw Linseed Oil in pipes	per gallon	0 2 10
,, ,, ,, in barrels	,,	0 2 11
,, ,, ,, in drums	,,	0 3 1
Boiled ,, ,, in pipes	,,	0 3 0
,, ,, ,, in barrels	,,	0 3 1
,, ,, ,, in drums	,,	0 3 3
Turpentine, in barrels	,,	0 2 3
,, in drums	,,	0 2 5
Genuine Ground English White Lead	per ton	22 0 0
Red Lead, Dry	,,	22 10 0
Best Linseed Oil Putty	per cwt.	0 9 0
Stockholm Tar	per barrel	1 10 0

VARNISHES, &c.

	per gallon. £ s. d
Fine Elastic Copal Varnish for outside work	0 16 6
Best Elastic Copal Varnish for outside work	1 0 0
Best Elastic Carriage Varnish for outside work	0 16 0
Best Hard Oak Varnish for inside work	0 10 6
Best Extra Hard Church Oak Varnish for inside work	0 10 6
Fine Hard Copal Varnish for inside work	0 16 0
Best Hard Copal Varnish for inside work	1 0 0
Best Hard Carriage Varnish for inside work	0 16 0
Extra Pale Paper Varnish	0 12 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
Best French and Brush Polish	0 10 0

TO CORRESPONDENTS.

NOTE.—The responsibility of signed articles, letters, and papers read at meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

We are compelled to decline pointing on books and giving addresses.

Any commission to a contributor to write an article is given subject to the approval of the article, when written, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays.* N.B.—We cannot publish tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of tenders accepted unless the amount of the tender is given, nor any list in which the lowest tender is under £100, unless in some exceptional cases and for special reasons.]

* Denotes *accepted.* † Denotes *provisionally accepted.*

ERITH (Kent).—For the erection of engine and boiler house, &c., for the Urban District Council. Mr. Harold Hurd, Surveyor, Erith U.D. Council. Quantities by Mr. W. Egerton, 12, Queen's-road, Erith:—

Messrs. Radford & Greaves, Derby†

Section	L	£3,275	4	4
,,	M	524	9	1
,,	N	292	11	2
,,	O	331	1	7
,,	P	104	8	0
Total.....		£4,527	14	2

HARROW.—For the erection and completion of offices, residential flats, and shop premises in the Peterborough-road, Harrow-on-the-Hill, Middlesex. Messrs. Clarke & Charles, architects. Quantities by Mr. H. H. Robinson:—

Hastings & Ladley	£5,542	Gough & Co.	£4,092
T. Turner, Ltd.	4,747	Chinchen & Co., Kensal Green*	3,974
Kimberley	4,695	C. Simmons	3,897
Miskin & Sons	4,632		
Waterman	4,167		

HARROW.—For alterations and additions to the post-office, Harrow-on-the-Hill. Messrs. Cowell & Shaw, architects, 49, Finsbury-pavement and West-street, Harrow:—

Groom & Collins	£589	H. Woodbridge*	£547
A. J. Batcheler	552		

[All of Harrow.]

LUTON.—For the erection of a fire-station, &c., Church-street and St. Mary's-road, for the Town Council. Mr. A. J. L. Evans, Borough Engineer and Surveyor, Town Hall, Luton:—

Thomas Smart	£1,898	W. G. Dunham, Luton*	£1,767
T. & E. Neville	1,797		

NEATH (Wales).—For the erection of a gymnasium, for the County School Governors. Mr. D. M. Jenkins, architect, Gwyn Hall, Neath:—

John Snow, Neath* £795

STANFORD-LE-HOPE (Essex).—For the construction of sewage disposal works for the Orsett Rural District Council. Mr R. F. Grantham, C.E., 23, Northumberland-avenue, London, W.C.:—

Contract No. 3.

Killingback & Co.	£8 038	Shelbourne & Co.	£6,724
T. Adams	8,020	A. T. Catley	6,678
G. G. Rayner	7,724	A. & A. Streeter	6,136
Dowell & Co.	7,647	Jos. Jackson, Forest Gate*	5,691 19 9
Rogers & Co.	7,540	Wilson, Border, & Co.	5,197
Cooke & Co.	7,076		
W. Manders	6,960		
G. Osenton	6,852		

WHITLEY.—For the erection of sewerage works for the Urban District Council. Mr. J. P. Spencer, C.E., 30, Howard-street, North Shields:—

	Section No. 1. £ s. d.	Section No. 2. £ s. d.	Total. £ s. d.
J. & W. Simpon	8,150 0 0	6,685 0 0	14,835 0 0
G. E. Simpson	6,849 16 8	6,420 0 0	13,269 16 8
W. Dykes	6,831 15 6	5,908 10 0	12,740 5 6
W. & J. Lant	6,719 16 8	4,565 13 11	11,385 10 7
G. Bell	5,348 13 7	4,647 17 2	9,996 10 9
T. & J. McLaren	5,256 14 0	5,591 12 0	10,848 6 0
Hudson & Sons	5,150 0 0	4,486 0 0	9,636 0 0
Walter Craig	5,142 4 8	6,325 14 9	11,467 19 5
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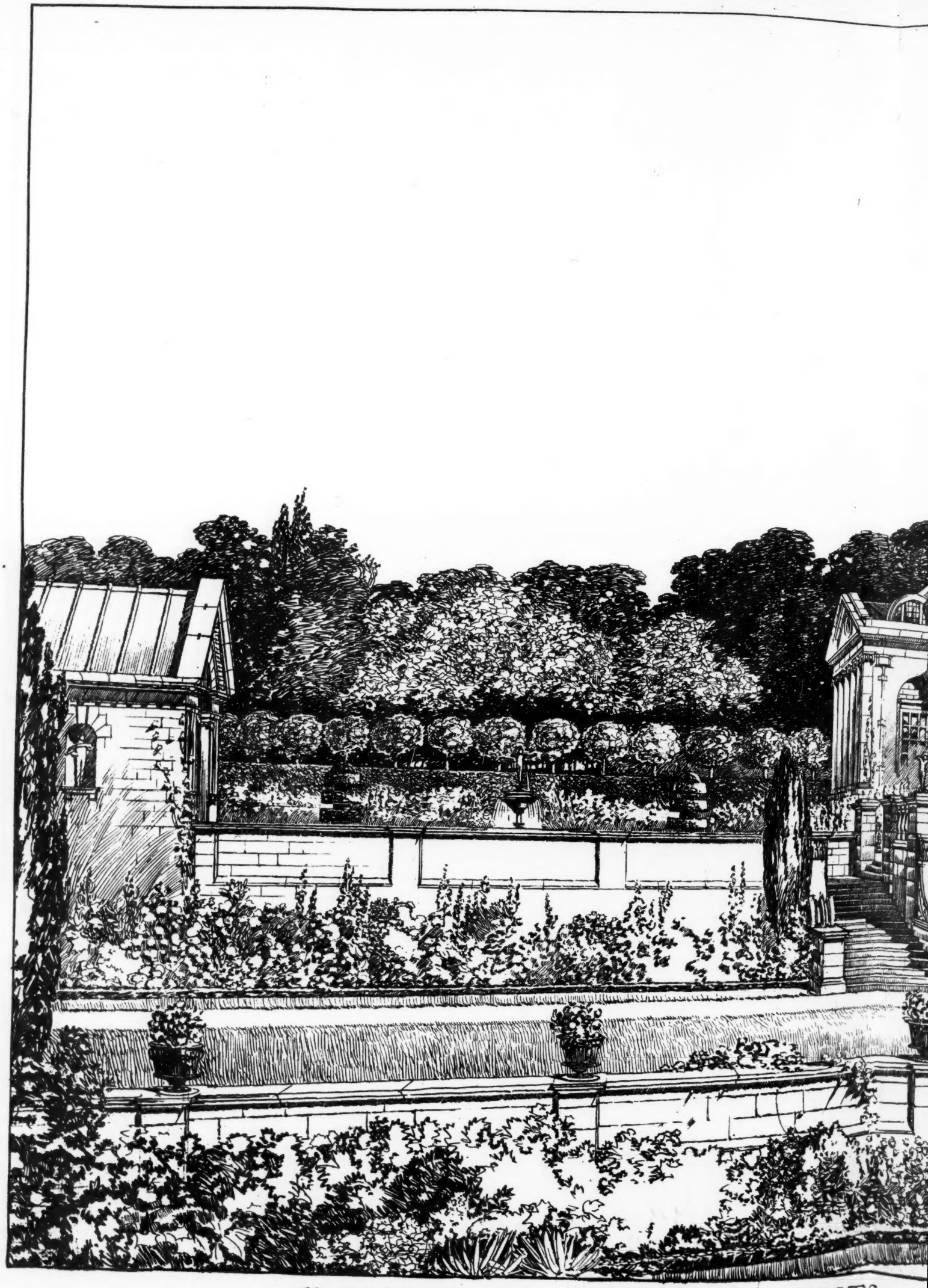

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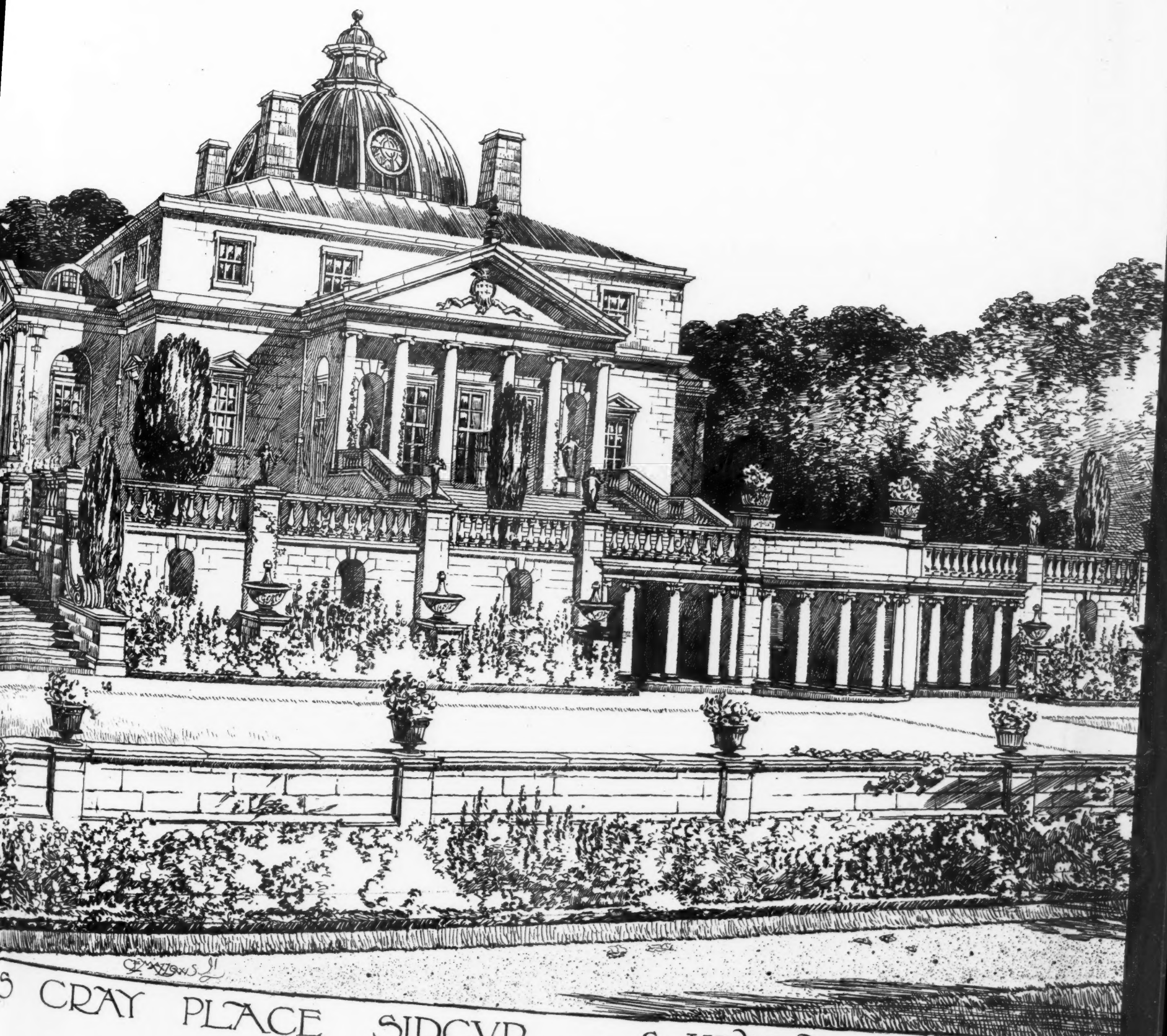

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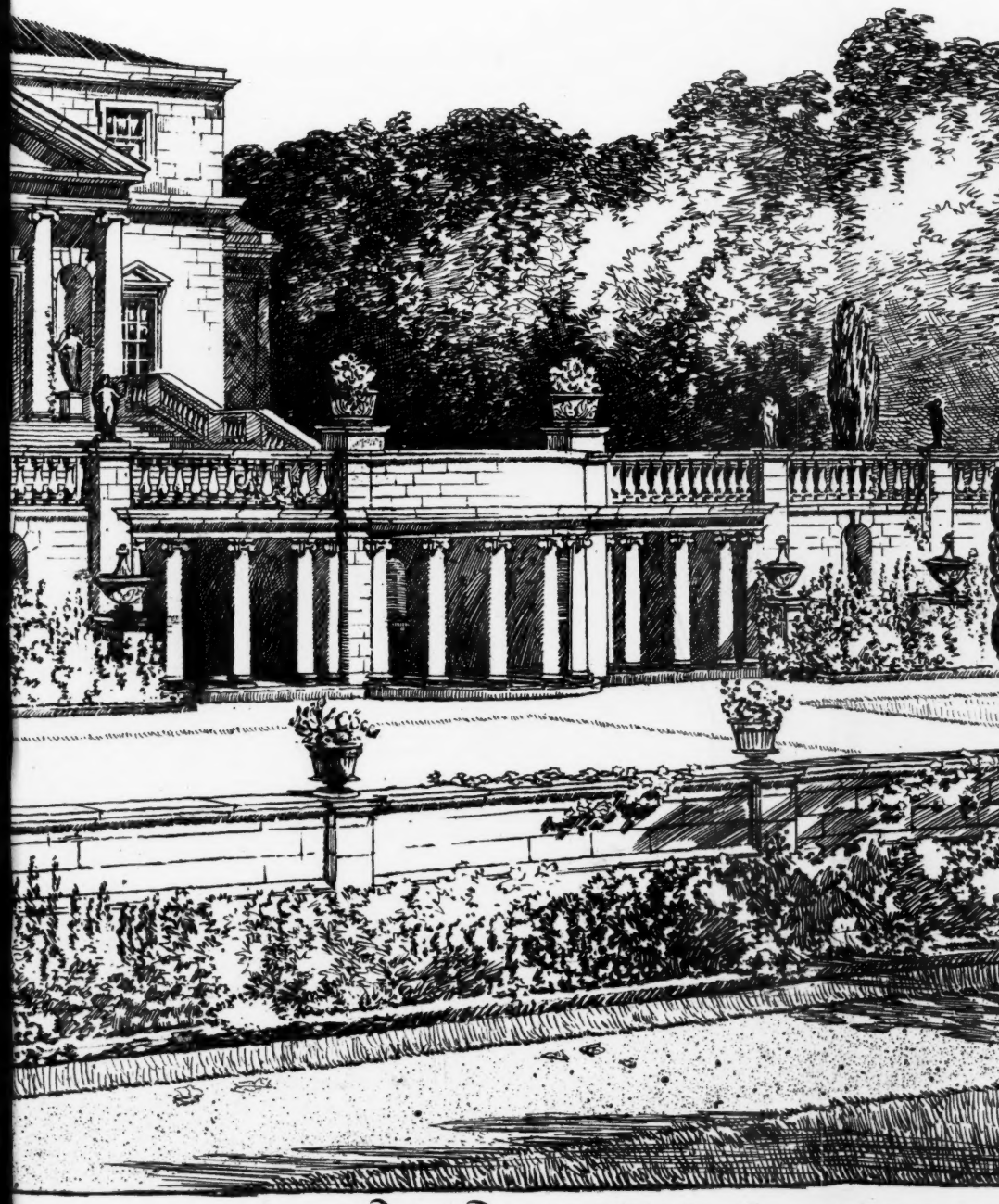

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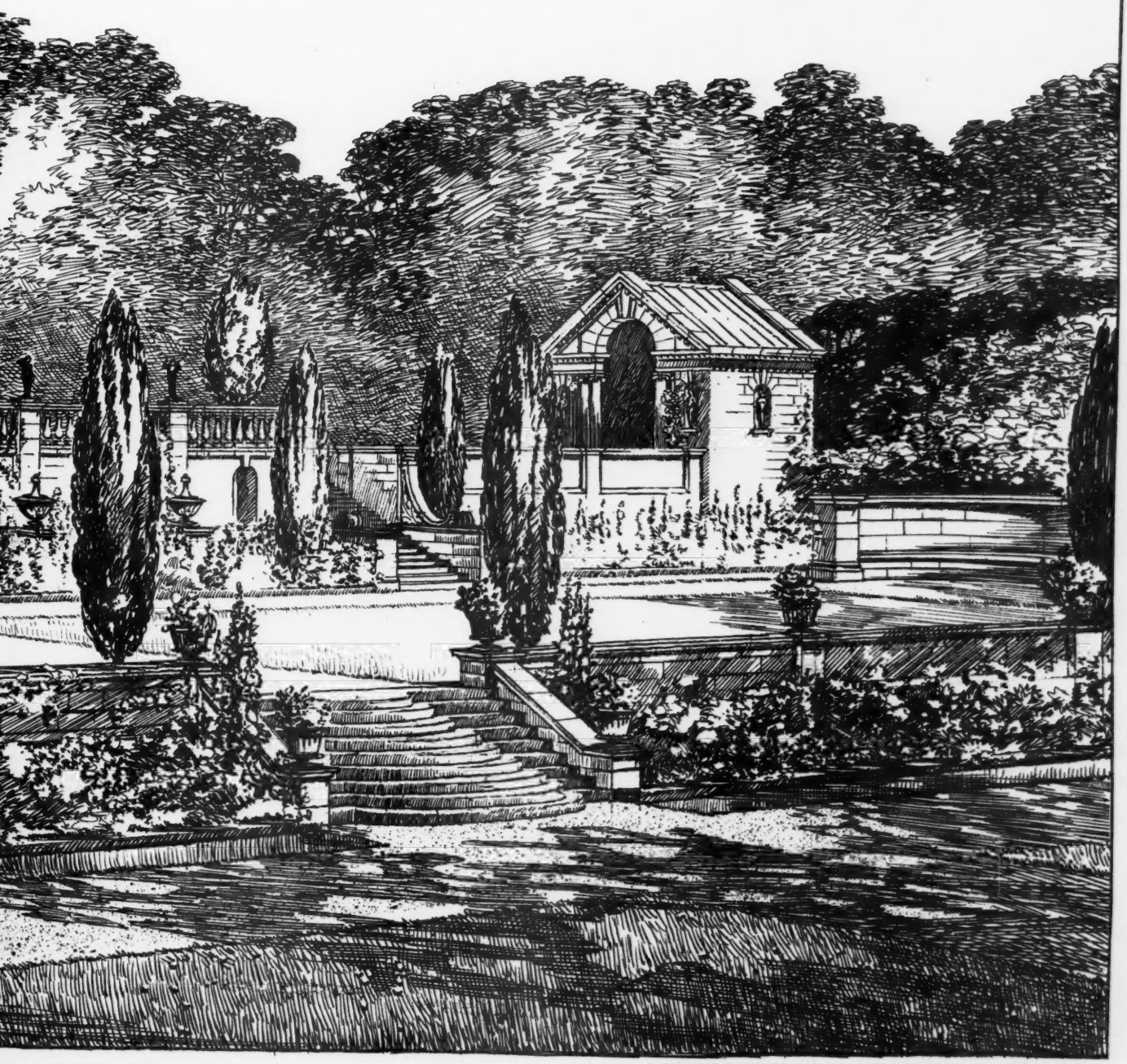

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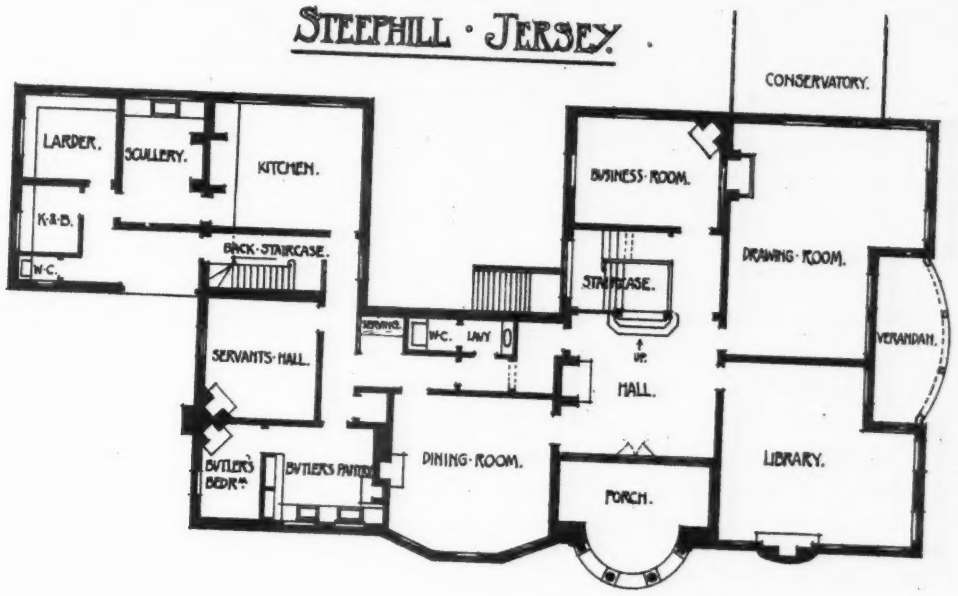

GROUND PLAN.

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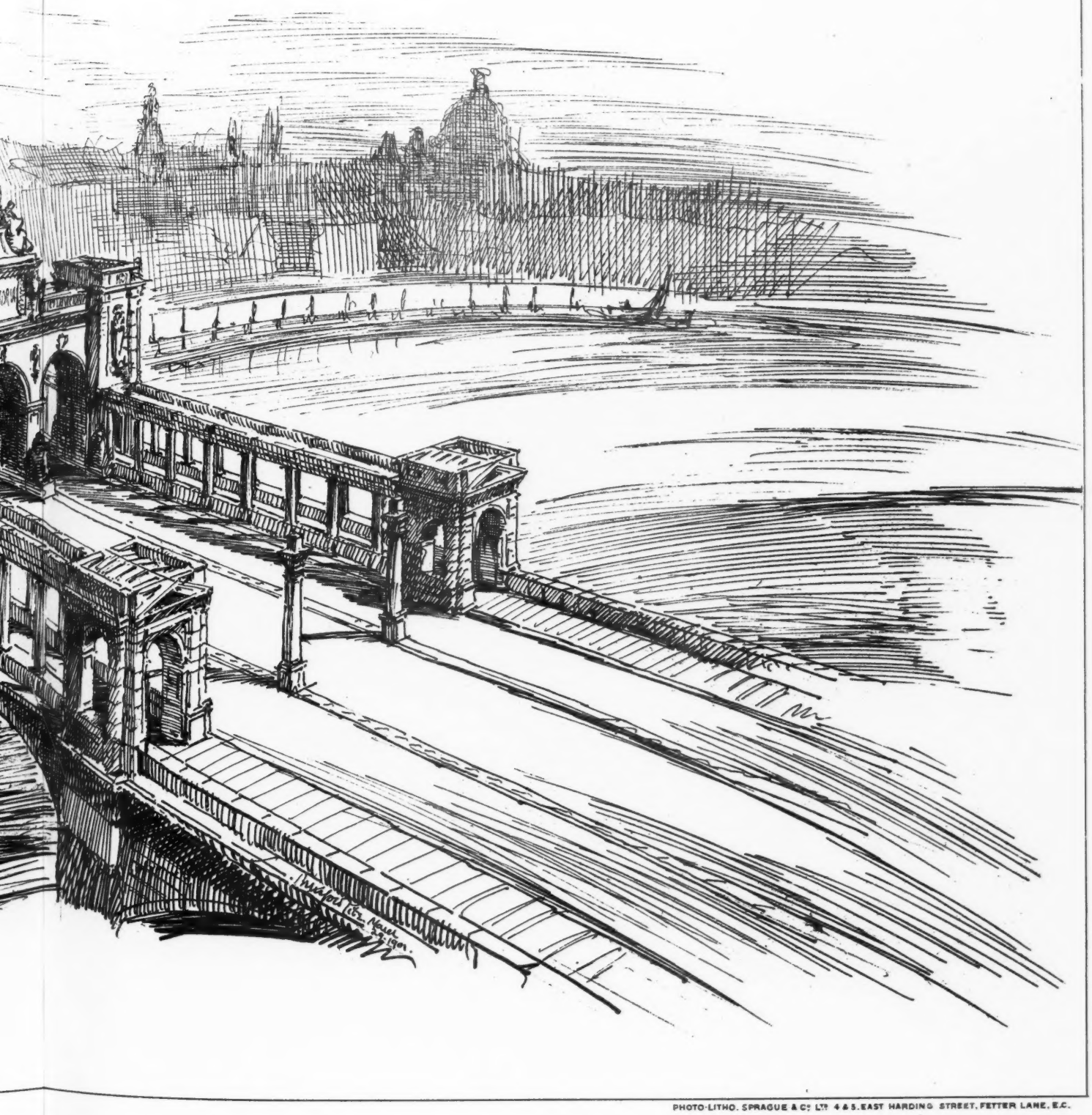

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